SONY®

Training Manual

Direct View Television

AA2U Chassis

Models: KV-32FV16 KV-36FS16
KV-32FV26 KV-36FV16
KV-36FS12 KV-36FV26

Circuit Description and Troubleshooting

Course: CTV-28

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Introduction

Overview

This course will cover the new Sony AA2U chassis. These sets are 32”and 36” only. This chassis is very similar to the AA2W chassis that was released last year. CTV-26 was a half-day course that covered portions of that chassis. Consequently, this book will only cover new circuitry and circuitry not covered in CTV-26.

A copy of the CTV-26 deflection circuits will be included in the Appendix. Refer to it for information and troubleshooting techniques for the horizontal and vertical sections of the AA2W and AA2U chassis.

There were a few improvements made to the AA2U chassis from the AA2W chassis. They are as follows:

- A 16-bit processor is used to enhance the OSD. This year’s menu is much more colorful and easier to use.
- A change has been made in the way the NVM is powered and used.
- A new PIP processor is used that eliminates the need for a chroma decoder in the PIP path.
- A new 3D Comb Filter is used which contains a built-in A\D Converter. No external A\D Converter is needed.
- The tuner has been changed from the BTF-WA411 to the BTF-WA412.
- Self-Diagnostics has been added.

CTV-28 Objectives

- Cover the features of the AA2U chassis so the students know what they are.
- Show how the NVM is powered and used. Talk about the service mode and what the various sections of adjustments do, what adjustments should be performed and what adjustments should always contain the same data.
- Show the video paths so the students know what they are and how they can be troubleshot.
- Discuss Self-Diagnostics and how they can aid in quickly diagnosing a broken set.
- Show pictures that highlight easy-to-get-to test points.

Service Manuals

As we move into the information age, Sony will no longer be producing paper service manuals. Beginning January 2001 all service manuals will be delivered via CD-ROM. As an interim step, the service manual for the 32-inch AA2U models (KV-32FV16 and KV-32FV26) comes with a CD-ROM. The block diagrams, component locations and schematics are supplied in the paper manual. The rest of the manual, including the adjustment section and parts list, is contained on the CD. Keep this in mind when you need to perform a service call on these models. You may need to bring a PC with you or print portions of the manual that you think you may need.

Features

Overview

The following section discusses the various features of the AA2U models. These features will be separated into four categories: Audio, Video, Convenience and Input/Output. The following models use the AA2U chassis:

AA2U chassis:

KV-32FV16
KV-32FV26
KV-36FS12
KV-36FS16
KV-36FV16
KV-36FV26

Audio Features

- All models contain the **Auto Mute** function. Auto Mute mutes the audio when no signal is received. This prevents the loud static noise from being heard when no station is received. The display will also indicate No Signal in the lower left-hand corner. This is important to remember because if the tuner has a poor reception problem the customer may complain of no audio.
- All models are **Stereo** with **Auto SAP.**
- All "FV" models contain the **Steady Sound Auto Volume, SRS 3D, Dynamic Acoustic Chamber (DAC) Speaker System** and **15Wx2** of audio power.
- The "FV26" models contain the **Wireless IR Headphone** feature.
- The "FS" models contain Matrix Surround and output 5Wx2 audio power.

Video Features

All models contain the following video features:

FD Trinitron WEGA TV
Dynamic Focus
Vertical Aperture Compensation
Velocity Modulation w/ control
Color Temperature Adjustment
Magnetic Quadra-pole

- All "FV" models use a **3D Digital Comb Filter**.
- All "FS" models use a **3-line Digital Comb Filter**.
- All "FV" models contain the **Enhanced 16:9 Mode.** The "FV26" contain an Auto 16:9 Enhancement. This means these models have the choice of Auto, ON or OFF, while the "FV16" models have the choice of ON and OFF.

Convenience Features

All the AA2U models contain the following Convenience features:

Speed Surf Tuning
Advanced On-screen Menu
Channel Label
Video Label
Multi Language Display
Jump Channel
Favorite Channel or Favorite Preview
Clock Timer (2 events)
Sleep Timer (15/30/45/60/90)
V Chip Parental Control
XDS/Closed Captioning
Auto Channel Programming
Preset Program Palette
Customer Tilt Control

- All models have 2 Tuner PIP except the KV-36FS12. The 2 Tuner PIP has the **Freeze Memo** feature.

Input/Output

	FS12	FS16	FV16	FV26
S Video Front/Rear	0/1	0/1	1/1	1/1
Composite Front/Rear	1/2	1/2	1/2	1/2
Component (Y/Pb/Pr)	1	1	1	1
Fix/Var. Out	Yes	Yes	Yes	Yes
RF Inputs	1	2	2	2
Monitor Output	No	No	Yes	Yes
S Link Control	No	No	Yes	Yes

Feature Glossary

Audio Features

Auto Mute – Mutes the audio output when the tuner receives no signal. This keeps the loud volume from occurring due to static.

Auto SAP – If activated, Auto SAP automatically switches to the SAP audio if it is present.

Steady Sound Auto Volume – Regulates the volume of the audio so there are no sudden fluctuations.

SRS 3D – A digital signal-processing algorithm that simulates surround sound using only two speakers.

Dynamic Acoustic Chamber (DAC) – A speaker enclosure that uses the cabinet to improve sound quality.

Wireless IR Headphones – Wireless headphones are included with "FV26" models.

Video Features

Dynamic Focus – Automatically adjusts the focus to improve focus on certain parts of the screen.

Magnetic Quadra-pole – Controls the electron beam magnetically to enhance picture resolution.

Trinitone Color Temperature Adjustment – Enables the user to adjust the color temperature to warmer (redder) or cooler (bluer) in order to match the program.

Enhanced 16:9 Mode - This mode uses vertical compression to enhance "anamorphic" widescreen video from DVDs. The Auto Mode reads data in the vertical blanking area to sense if the picture is 16:9. If it is, the set will automatically switch to the vertical compression mode.

Velocity Modulation Scanning w/control - Sharpens the picture definition by varying the beam scanning rate to give every object a sharp, clean edge. There are settings for High, Low and OFF.

Vertical Aperture Compensation - Sharpens picture definition and edge detail on the vertical plane.

Y/Pb/Pr - Delivers optimum picture quality by supplying separate connections for luminance (Y), blue color difference (P B) and red color difference (P R). Ideal for DVD players and Digital Television (DTV) set top receiver/decoders.

3-line Comb Filter – Looks at the line above and below the line being processed to separate the chroma and luminance in a composite video signal. This reduces dot crawl to produce a better picture.

3D Comb Filter – Looks at the line above and below the line being processed, along with the same three lines in the frame before and after to optimally remove the chroma component from the Y in a composite video signal. This reduces dot crawl and other noise to produce the best picture possible.

Convenience Features

XDS (Extended Data Service) - Receives new information services that some broadcasters are adding to their signals, including time, station call letters, and programming information (where available).

Advanced On Screen Menu – A new, colorful on screen menu that is more intuitive and easier to use.

Preset Program Palette – Picture types that are preset. These include Vivid, Standard, Sports and Movie.

Freeze Memo – Allows you to save an item on the screen in the PIP window while the main picture continues in real time.

V-Chip Parental Control - Allows parental control over rated television programs.

Speed Surf Tuning - "Rapid Fire" channel change. Allows the viewer to quickly scroll through channels.

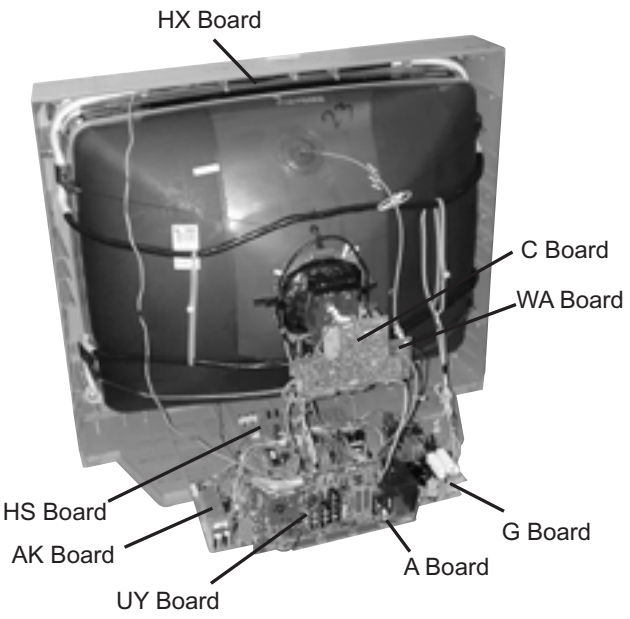
Favorite Channel - Gives you fast one-button access for up to eight favorite channels.

Favorite Preview - In 2-tuner PIP Models, viewers can preview programming on up to eight favorite channels in the PIP box while current channel programming remains in the main picture.

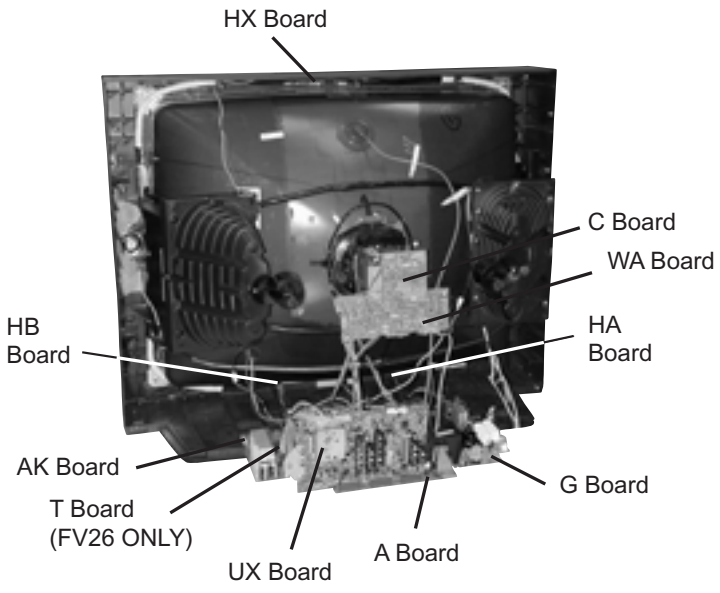
Board Descriptions

Name	Description
A	Tuning Micon, Y/C Jungle, Tuner, Pincushion, H Deflection, V Deflection, H Deflection
AK	Audio Amp, Surround Sound, Sub tuner, S-Link
C	CRT Drive
G	Power supply
HA	Front A/V Inputs, Menu Buttons
HB	IR detector
HS (FS12 and FS16 only)	Front A/V Inputs, Menu Buttons, IR Detector
HX	Buttons
T(FV26 Only)	IR Headphones
UX(FV Only)	3D Comb Filter, A/V Switch, Audio Control, SRS, PIP Encode
UY(FS Only)	3 Line Comb Filter, A/V Switch, Audio Control, SRS 3D, PIP Encode (except FS12 model)
WA	Velocity Modulation, Quadrapole

FS12 & FS16



FV16 & FV26



Overall Block

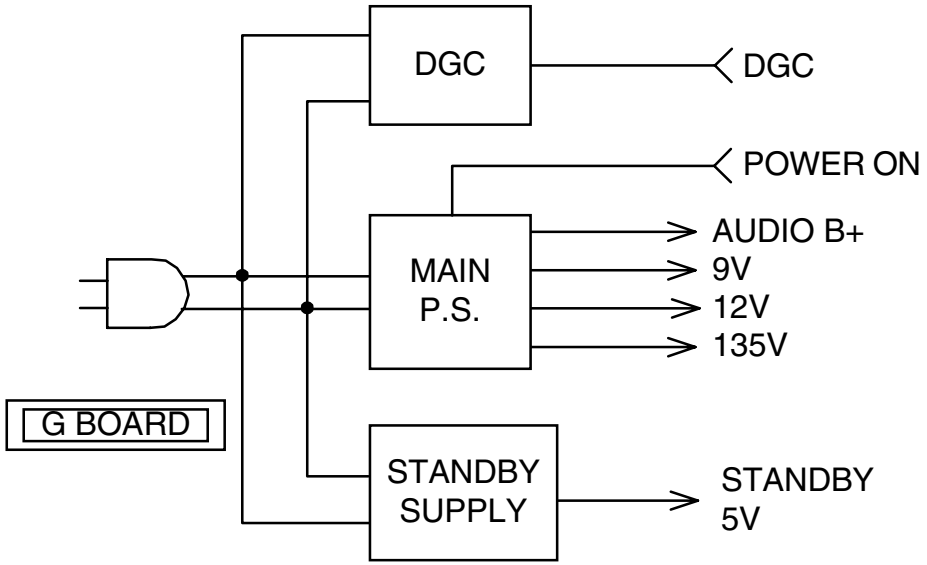
G Board

The G board contains all of the power supplies, and the degaussing circuit. AC comes into the G board through the power cord to the previously mentioned circuits.

The standby power supply creates the Standby 5 volts needed to power the Tuning Micon, remote sensor and key inputs.

The Main Power Supply is turned ON by the Power On line. This signal comes from the Tuning Micon to turn the set ON. The Main Power Supply creates Audio B+, 9V, 12V and 135V.

The Tuning Micon turns ON the degaussing circuit immediately after the set is powered up. The degaussing circuit feeds the AC line current to a degaussing coil, which removes any magnetic fields that may have developed in the picture tube. It operates for about 3-4 seconds each time the set is turned ON.



POWER SUPPLY BLOCK

A/V Switching

The Video 1, 3 and 4 audio and video inputs are on the UX board. The Video 2 A/V inputs are located on the HB Board. The signals are routed to the UX board through the A board. The A/V input from the Main Tuner on the A board and the A/V input from the Sub Tuner on the AK board are also sent to the UX board. The UX board contains the A/V Switch. This IC switches the appropriate audio and video signals to the audio and video circuits.

Audio

The audio signal is routed from the UX board to the AK and T boards. The AK board contains any audio processing, such as SRS or matrix surround sound, and the audio amp. The audio amp drives the speakers. The AK board also outputs signals for the Monitor Out and the Var./Fix output.

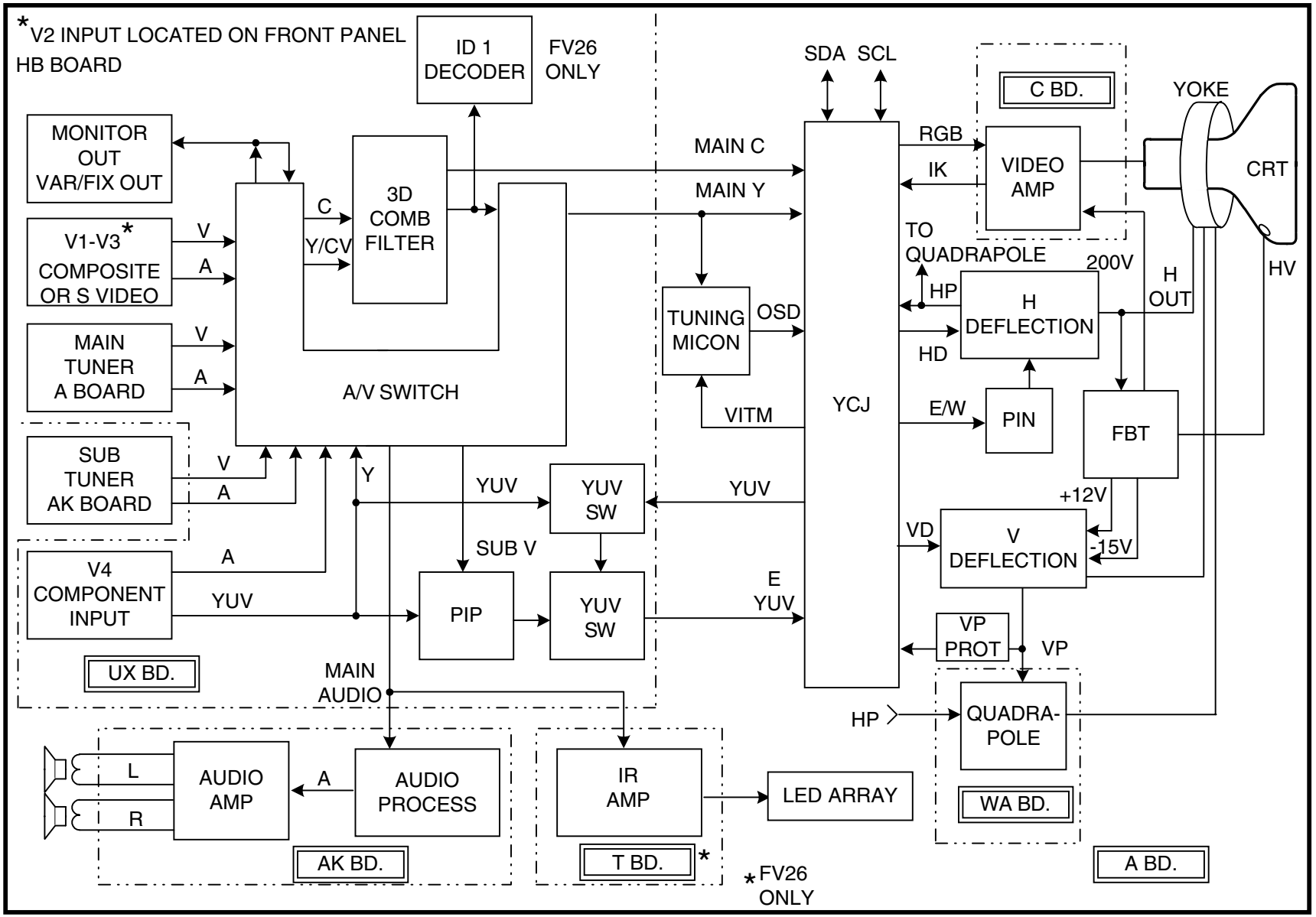
The audio on the T board is modulated and amplified by the IR Amp. The IR Amp outputs to an LED array for use with the external IR headphones.

Video

The composite and S video inputs are routed through the 3D Comb Filter. The C output from the Comb Filter becomes Main C while the Y is sent back to the A/V Switch and also sent to the ID 1 Decoder. An ID 1 Decoder extracts data about the aspect ratio of a signal from the vertical blanking area. The Y signal that is output from the A/V Switch becomes Main Y.

The Main Y and C signals are output to the A board and then to the YCJ. These signals are decoded to Y, R-Y and B-Y and are output to the YUV SW. This IC is used to select either the Component video from the YCJ or the component video from the Video 4 input. The Main Y signal is also input to the Tuning Micon for V Chip decoding.

The selected signals are input to another YUV SW. This YUV switch outputs either the main video signal or the main video signal mixed with the PIP signal. These outputs are input to the E inputs of the YCJ. This video is processed and output as RGB from the YCJ. The RGB signals are sent to the C board where they are input to the CRT Drive. The CRT Drive amplifies and inverts the signals and applies them to the picture tube's cathodes.



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Deflection

Horizontal

When the set is turned ON and +9 volts is received by the YCJ, the YCJ will output horizontal drive pulses. These pulses are amplified and output to the horizontal yoke and FBT. The horizontal yoke uses the horizontal output to control the beam scan across the face of the tube.

The FBT is used to create several voltages. They are High Voltage, 200 Volts, +12 and –15 volts, and ABL. The High Voltage, necessary for beam acceleration, is connected to the second anode of the picture tube. The 200 volts is used to power the video amp located on the C board. The +12 and –15 volt lines are created to power the Vertical Deflection IC. If these signals are missing, the set will indicate a vertical problem even though the problem is actually in the horizontal or FBT section. The ABL signal is input to the YCJ so that it can adjust the levels of the video signal to keep the brightness at a consistent level.

The Horizontal Deflection circuit also returns a sample pulse, HP, to the YCJ to ensure that the phase of the input and output is the same. The HP signal is also input to the Quadra-pole circuit to create the signal needed to shape the beam in the corners of the picture tube.

Pincushion

The pincushion correction is controlled by the E/W signal from the YCJ when the horizontal drive pulses are output. This signal is a 60 Hz parabola signal that is used to dynamically widen the picture as the beam scans from top to bottom. This signal also rides on a DC level, which is used to maintain the overall width of the picture. This DC level is changed using the HSIZ adjustment in the VP section of the service menu.

Vertical

The vertical drive signals are output from the YCJ when communications are established between the Tuning Micon and the YCJ. These drive signals are complementary, 180 degrees out of phase, and are sent to the Vertical Output circuit.

There are two types of vertical drive signals used. One is for normal 4:3 aspect ratio video and the other is for 16:9 compressed video. The Vertical Deflection circuit outputs the V Out signal to the vertical yoke. This signal is used to control the up and down beam scan of the tube.

The Vertical deflection circuit also outputs the VP signal. The VP signal is a sample of the pump-up pulse used to boost the B+ inside of the vertical output IC. This signal is input to the YCJ for vertical protection and also to the Quadra-pole circuit to create the necessary output to control the beam shape at the corners of the tube.

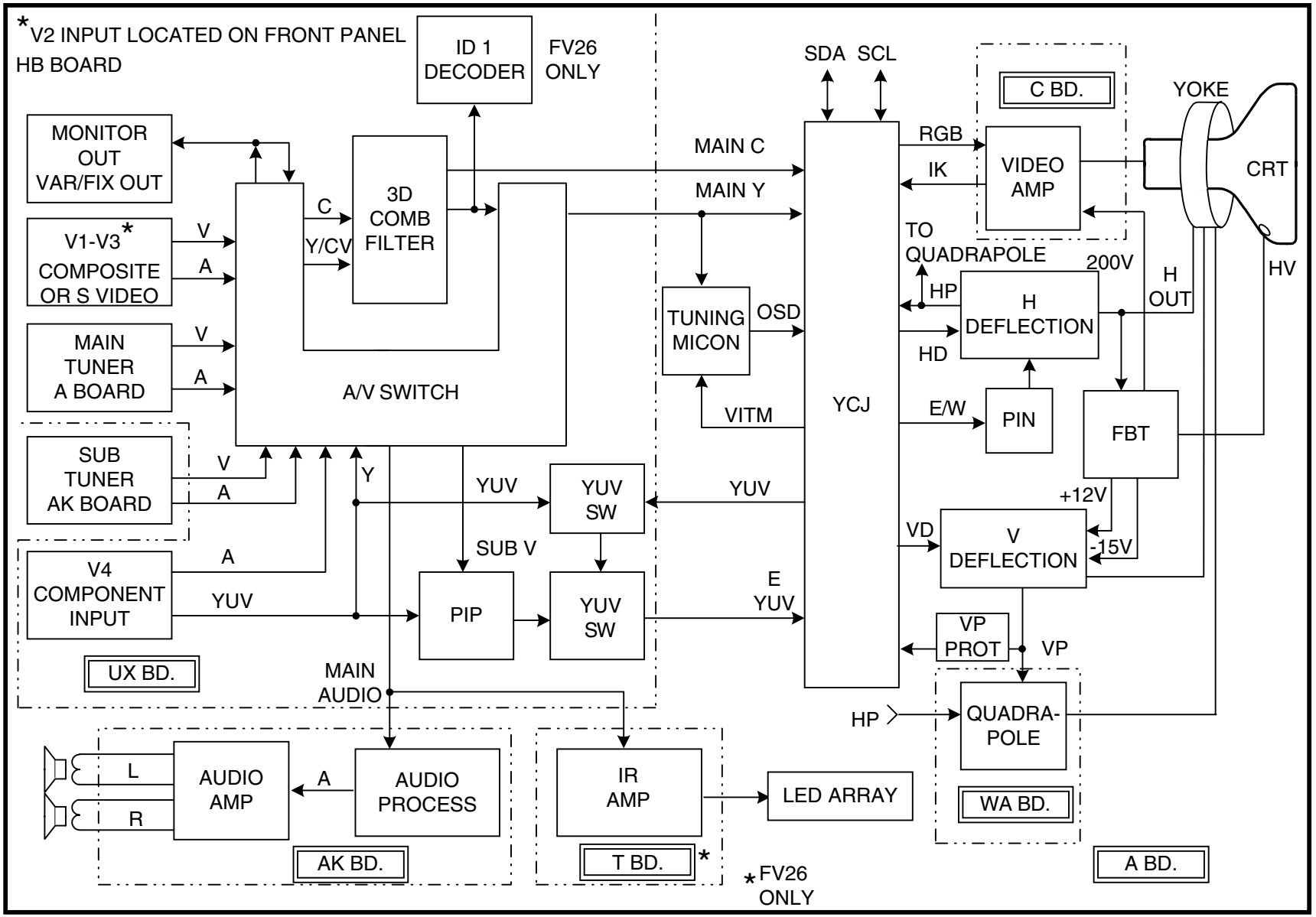
The Vertical Interval Timing (VITM) signal from the YCJ is fed back to the Tuning Micon to control the timing of the I^2C bus. This ensures that I^2C data will only be sent during the vertical-blanking interval. If the VTIM signal is missing, there will be no OSD and the PIP window will roll vertically.

Quadra-pole Focus

Due to the flat screen in a set that uses a FD Trinitron tube, the focus in the four corners of the set has changed. While the dots are still in focus at the four corners, the spot of the beam has changed from round to elliptical. The Quadra-pole circuit is used to make these beam spots round.

The beam spots are made round again by supplying a signal to four coils mounted on the yoke. The magnetic fields created by the signals applied to the coils reshape the beam spots.

The VP and HP signals are samples of the output signals of the vertical and horizontal deflection circuits. These signals are wave shaped to create two differential parabola signals and applied to the four coils. Their magnetic fields reshape the beam.



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Reset and NVM Operation

Overview

This year the reset circuit and NVM circuits have changed slightly. The 5 volts developed on the reset line after reset occurs is used to power the NVM.

Reset

The set is reset anytime the AC cord is plugged in or power from the AC cord is switched OFF, then ON. Whenever this occurs Standby 5V is developed by the Standby Power Supply on the G board and applied to the Tuning Micon at IC001/16. It is also applied to IC003/5 Reset Input.

IC003 Reset contains a threshold comparator that holds pin 4 LOW until the Standby 5V line reaches a certain voltage. When this voltage is reached, IC003/4 becomes an open collector circuit. This allows the Standby 5V to charge C077 through R035. Since C077 acts as a short initially, it holds IC001/12 I-Reset LOW for the time it takes to charge C077. This time is determined by the value of R035 and C077. Since power is applied to the micro during this time, reset occurs after C077 charges to a sufficient level.

Since the charge across C077 will be 5 volts, the Reset line is now also used to power the NVM. This is to prevent the corruption of data during loss of input voltage or low voltage situations. This 5 volts is applied to IC002 NVM through R039.

NVM Operation

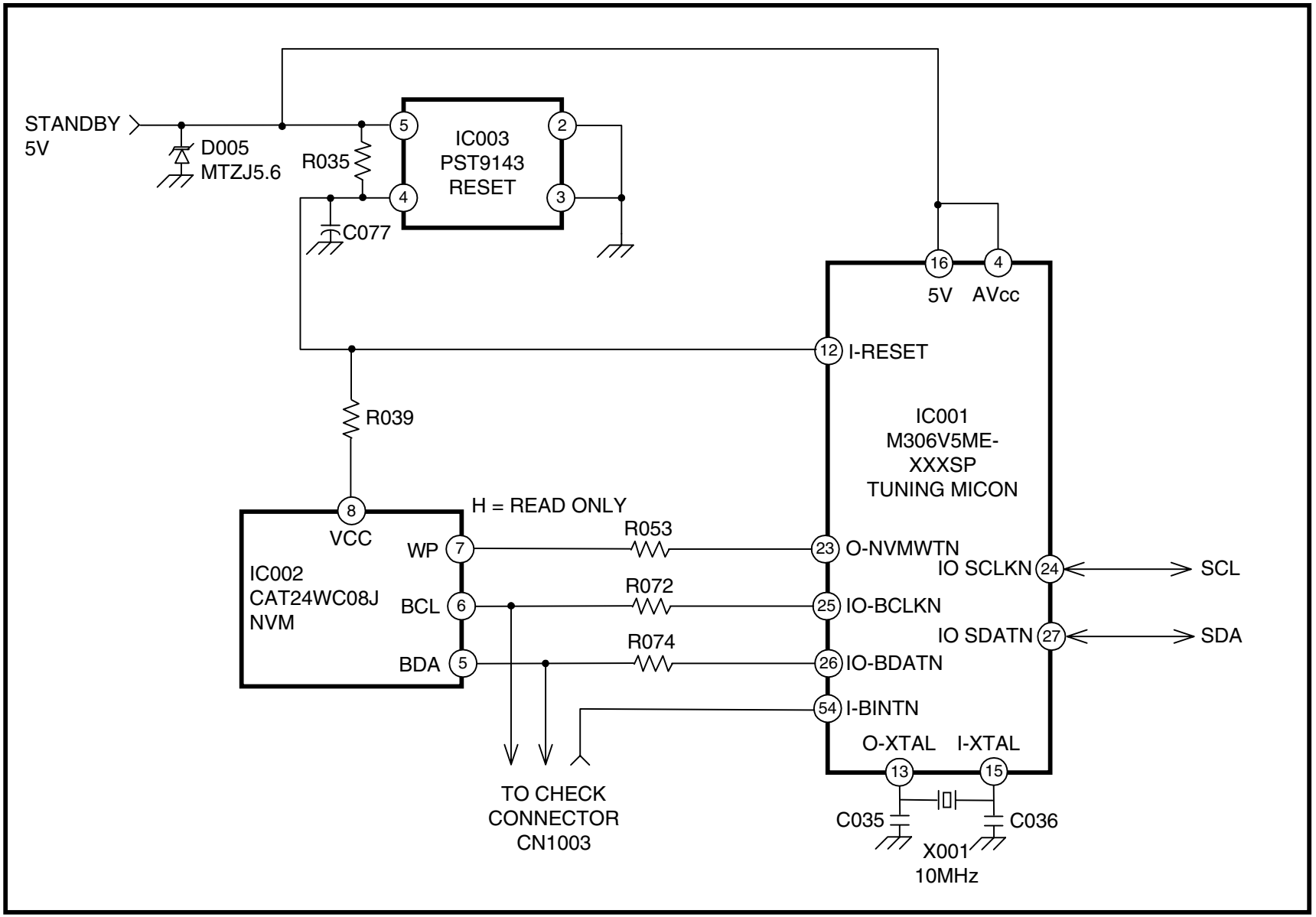
After Reset occurs, the first external operation performed by IC001 Tuning Micon is to read the data from the NVM and place that data into its corresponding internal registers. This is done to speed operations since the internal registers (RAM) of IC001 Tuning Micon are much faster than the registers in IC003 NVM. This is also why we can change data in the service mode and get back to the original data by pressing 0 (Read) Enter if we have not written to the NVM by pressing Muting (Write) Enter. The set will continue to operate from this data until the set is unplugged and Reset occurs again.

IC002/7 Write Protect is normally held HIGH by IC001/23 O NVMWTN. When IC001 Tuning Micon wants to write to the NVM IC001/23, O NVMWTN goes LOW. When the write protect line is LOW, the NVM can be written to and read from through the I^2C bus.

The NVM and Tuning Micon communicate on a separate bus from all other I^2C communications. This bus is called the B bus and is only connected between the NVM, Tuning Micon and CN1103 Check Connector. This connector is used at the factory to perform various functions involving the NVM and the Tuning Micon. When outside control of the I^2C B bus occurs, the I-B INTN is held LOW and commands are given from the outside source.

NVM Jig Use

The procedure for using the NVM Reader/Writer jig is outlined for all models in General SB 31. For these manuals you need to attach the clip to the NVM and place the ground clip on IC001/23 O-NVMWTN. No grounding of the Reset line or crystal needs to be done since the Tuning Micon is not powered. This is because the NVM and Tuning Micon no longer share a common power line.



RESET

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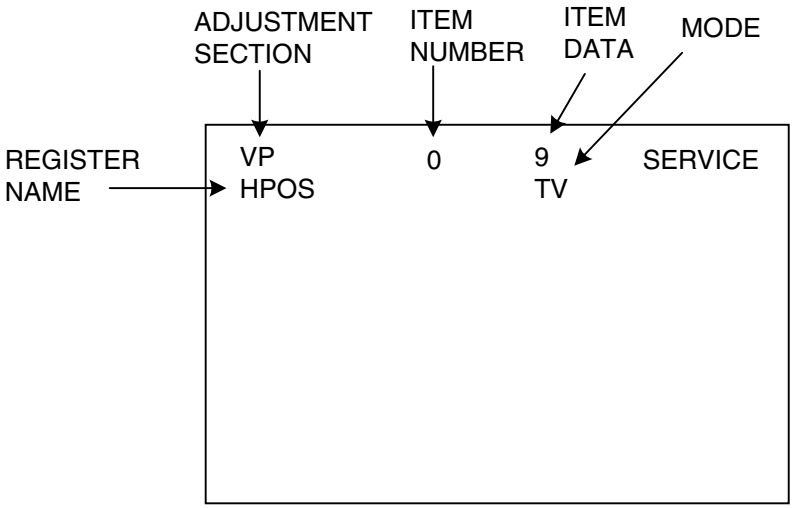
Service Mode

Overview

There have been several changes to the service mode in the past few years. There also have been changes to the way the service mode information is shown in the service manual. This section will discuss how to use the service mode and how to use the Adjustment Items section of the service manual.

Service Mode Display

The method used to enter the service mode has not changed, press “Display” “5” “Vol +” “Power” on the remote control in quick sequence. The set will turn ON with the on-screen display shown below.



SERVICE MODE DISPLAY

Let’s examine this service Menu OSD. It is divided into the following sections:

- **Adjustment Section** – This indicates what IC is effected by the data in this register. The different IC types are listed in the service manual. There are three adjustment sections that do not follow this format. They are CCD, Palette and ID modes. The differences in these sections will be discussed later. Use the 2 and 5 buttons on the remote control to move between adjustment sections.
- **Register Name** – Located underneath the Adjustment Section, the register name refers to the specific register that will be effected. Each register name is used to adjust the parameters of an IC by changing the Item Data. Use the 1 and 4 buttons on the remote control to move to the different registers.
- **Item Number** – Each Adjustment Section contains a different number for every Register Name. The item number always starts with zero and continues to increment for each Register Name. The amount of numbers varies for each section.
- **Item Data** – This is the number for the data that the named register contains. Adjusting this number changes the parameter effected by the register. Use the 3 and 6 buttons on the remote control to change the Item Data.
- **Mode** – Located underneath the Item Data, this shows which mode the set is in. In the case of AA2U, the modes are TV, Video 1, Video 2, Video 3 and Video 4. Use the TV/Video button on the remote control to change modes.
- **Service** - This last item is an indication that the unit is in the Service Mode.

Adjustment Items

The facing page shows an excerpt from the service manual. We will explain the purpose of this table.

Item Number

The first column in the table refers to the Item Number mentioned previously.

Register Name

The second refers to the Register Name. Each Register Name is used to adjust the parameters of an IC by changing the data.

Adjustment Section

The third shows the Adjustment Section. The example shows that the VP (Video Processor) registers will be effected. It also indicates that these registers effect the CXA2131AS. This is IC355 YCJ.

5-4. ADJUSTMENT ITEMS

	Register Name		Description	Data Range	Adj/Fix	Initial Data	36" Average Data FS	FV16	FV26	Comments
0	HPOS	VP CXA2131AS	H-Position	0-63	*Adj*	7		9		0: 2 ms delay, 64: 2 ms advance
1	HSIZ		H-Size	0-63	*Adj*	10		15		EW DC bias, 0: -0.5V, 31: 0V, 63: +0.5V
2	VBOW		AFC Bow	0-15	*Adj*	6		7		0: top/bottom delay 900ns, 7: center, 15: top/bottom advance 900ns
3	VANG		AFC Angle	0-15	*Adj*	5		5		0: top delay/bottom advance 650ns, 7: center, 15: top advance/bottom delay 650ns
4	TRAP		Trapezium Adjustment	0-63	*Adj*	6		8		0: 1.5ms advance, 15: 1.5ms delay
5	PAMP		Pin Compensation	0-63	*Adj*	32		30		0: 0.15Vpp, 31: 0.7Vpp, 63: 1.3Vpp
6	UCPN		Upper Corner Pin	0-63	*Adj*	36		35		0: -0.4V, 63: +0.4V
7	LCPN		Lower Corner Pin	0-63	*Adj*	36		35		0: -0.4V, 63: +0.4V
8	VSIZ		V-Size	0-63	*Adj*	0		7		0: -15%, 31: 0%, 63: +15%
9	VPOS		V-Position	0-63	*Adj*	31		39		0: -0.1V, 31: 0V, 63: +0.1V
10	VLIN		V-Linearity	0-15	*Adj*	7		6		0: 85% top enlarged, 7: 100% top normal, 15: 115% top compressed
11	VSCO		S-Correction	0-15	*Adj*	7		9		0: 0V added to VD, 15: 100mVpp added to VD
12	VZOM		16:9 CRT Zoom Mode On/Off	0, 1	FIX	0		0		0: Zoom Off, 1: Zoom On (top/bottom cut by 24% when ASPECT=31, RGB blanked in this interval)
13	EHT		Vertical Size High voltage Correction	0-15	FIX	4		4		0: Picture adjusted 0%, 15: Picture adjustment -5%
14	ASP		Aspect Ration Control 4:3 Mode	0-63	FIX	47		47		0: 75%(16x9 CRT Full), 31: 100% (4x3 CRT Full), 63: 110%
15	ASP1		Aspect Ration Control 16:9 Mode	0-63	FIX	47		47		0: 75%(16x9 CRT Full), 31: 100% (4x3 CRT Full), 63: 110%
16	SCRL		16:9 Vertical Scroll During Zoom	0-63	FIX	31		31		0: Scrolled toward top 32H, 63: Scrolled toward bottom 32H
17	HBSW		H Blanking Switch	0, 1	FIX	1		1		0: OFF, 1: ON
18	LBLK		Left Blanking	0-15	FIX	15		15		0: +1.2ms, 7: Center, 15: -1.2ms
19	RBLK		Right Blanking	0-15	FIX	0		0		0: +1.2ms, 7: Center, 15: -1.2ms
20	HDW		H Drive Pulse Width	0, 1	FIX	1		1		0: Normal Mode (25ms), 1: Narrow Pulse Width
21	EWDC		EW/DC Display 4x3 on 16x9 CRT	0, 1	FIX	0		0		0: OFF, 1: ON
22	LVLN		Picture Bottom Lin Adjust	0-15	*Adj*	0		0		0: 100%, 15: 85% Picture top compressed
23	UVLN		Picture Top Lin Adjust	0-15	*Adj*	0		0		0: 100%, 15: 85% Picture bottom compressed
24	RDRV		Red Drive	0-63	*Adj*	31		54		0: 1.5Vpp, 63: 3.0Vpp Red Signal Output
25	GDRV		Green Grive	0-63	*Adj*	31		46		0: 1.5Vpp, 63: 3.0Vpp Green Signal Output
26	BDRV		Blue Drive	0-63	*Adj*	31		37		0: 1.5Vpp, 63: 3.0Vpp Blue Signal Output
27	RCUT		Red Cutoff	0-15	FIX	7		14		0: 3.5mA IK, 7: 13mA IK, 15: 22.7mA IK
28	GCUT		Green Cutoff	0-15	*Adj*	7		10		0: 3.5mA IK, 7: 13mA IK, 15: 22.7mA IK
29	BCUT		Blue Cutoff	0-15	*Adj*	7		8		0: 3.5mA IK, 7: 13mA IK, 15: 22.7mA IK
30	RDR4		Video 4 Red Drive	0-63	*Adj*	31		44		0: 1.5Vpp, 63: 3.0Vpp Red Signal Output
31	GDR4		Video 4 Green Drive	0-63	*Adj*	31		36		0: 1.5Vpp, 63: 3.0Vpp Green Signal Output
32	BDR4		Video 4 Blue Drive	0-63	*Adj*	31		29		0: 1.5Vpp, 63: 3.0Vpp Blue Signal Output
33	RCU4		Video 4 Red Cutoff	0-15	FIX	7		14		0: 3.5mA IK, 7: 13mA IK, 15: 22.7mA IK
34	GCU4		Video 4 Green Cutoff	0-15	*Adj*	7		14		0: 3.5mA IK, 7: 13mA IK, 15: 22.7mA IK
35	BCU4		Video 4 Blue Cutoff	0-15	*Adj*	7		10		0: 3.5mA IK, 7: 13mA IK, 15: 22.7mA IK
36	SBRT		Sub Brightness	0-31	*Adj*	15		8		Sub Brightness
37	RON		Red Off	0, 1	FIX	1		1		0: OFF, 1: ON
38	GON		Green Off	0, 1	FIX	1		1		0: OFF, 1: ON
39	BON		Blue Off	0, 1	FIX	1		1		0: OFF, 1: ON
40	AXPL		Axis PAL	0, 1	FIX	0		0		0: Normal Axis, 1: Forced PAL Axis
41	CBPF		Chroma BPF On/Off	0, 1	FIX	1		1		0: BPF OFF, 1: BPF ON
42	COFF		Color On/Off	0, 1	FIX	0		0		0: Chroma OFF, 1: Chroma ON
43	TSSP		Sub Sharpness for TV Input	0-15	Fix by model	6	5		6	0=-12dB, 7=+3.5dB, 15=+9dB
44	TSPF		Sharpness fo for TV Input	0, 1	FIX	1		1		0=2.5MHZ, 1=3.0MHZ
45	VSSP		Sub Sharpness for Video Input	0-15	Fix by model	7	6		7	0=-12dB, 7=+3.5dB, 15=+9dB
46	VSPF		Sharpness fo for Video Input	0, 1	FIX	1		1		0=2.5MHZ, 1=3.0MHZ
47	YSSP		Sub Sharpness for YUV Input	0-15	Fix by model	7	6		7	0=-12dB, 7=+3.5dB, 15=+9dB

Description

The fourth column is the Description of the adjustment register. Typically this reflects the Register Name, as in the case of HPOS. It refers to the Horizontal Position adjustment. The descriptions of some Register Names are not as evident as HPOS, so it is always important to check the description before doing and adjustment.

Data Range

The next column is for the Data Range. This shows which numbers are available for the adjustment. In the case of HPOS, the range is from 0 to 63.

Adj/FIX

The Adj/FIX column refers to whether the data number in a register should vary from set to set. Adj means that different values could be found in every set. FIX means that the data should be the same in each set listed in that service manual. You should note that it is possible to change FIX settings, but they **should not** be changed. Registers that have FIX settings are shaded in gray in the Adjustment Items table.

Initial and Average Data

The next two columns, Initial Data and Average Data, are related to each other. Initial Data is the data that is stored in the NVM at the board level before the set is assembled and tested at the factory. Average data is the average value of the data found in a register from production samples at the factory.

If a register is shaded in gray (FIX, the value in the register should be the same as average data. There may be some occasions where the value was changed at a point in production. However if this occurs, the value should be very close and the difference may be unrecognizable. Therefore if all data is lost, all FIX data registers should be set to the average value.

If a register is not shaded in gray (Adj), the value in the register will be close to the average data value. If all the data is lost, all Adj registers should be set to the Initial data value and then adjusted according to the procedure in the service manual. These values should end up close or the same as the average data value when adjusted. However, this is not always true since the average value is just that, an average.

Comments

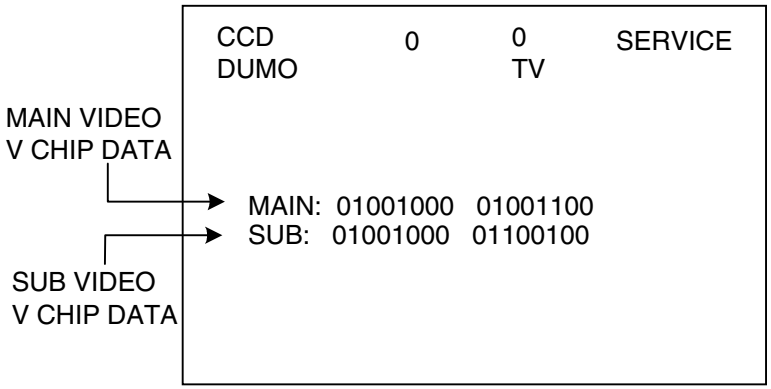
This column gives some more information about the registers parameters. Sometimes it helps in clarifying what the register does.

Other Service Mode Displays

There are three sections of the Service Mode that act differently from the standard adjustments. They are the V Chip OSD Test Register, Palette Adjustments and ID Adjustments. **Note: The override password for V Chip password is 4357 in all Sony televisions.**

V Chip OSD Test Register

The drawing below shows the display when in the V Chip OSD Test Register section of the display mode. You can get to this section by entering the service mode and pressing the “2” button to change the Adjustment Section until you get to CCD.



V CHIP OSD TEST REGISTER

This is a dummy section of the service mode. This means that these registers are not active. They will display the V Chip data being received by the Main V Chip in the Tuning Micon and Sub V Chip in the PIP Processor. This data is displayed for Main and Sub V Chip in two 8-bit words. If there is no V Chip data being sent by the station that is tuned, the data will show as all zeroes.

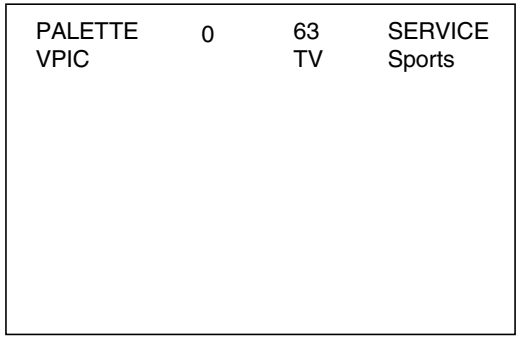
The table below shows the meaning of the bits in the two bytes. Bit 6 in each byte is set to a 1 when the V Chip system is active. Byte 1 Bit 5 is the flag for Sexually Suggestive Dialog. Byte 1, Bits 4 and 3 determine which ratings system will be used. If the data here is 0 and 1, the US TV Ratings system is in use. If the data is 0 and 0, the MPAA (Movie) Rating system is in use. Any other data combinations found here are for non-US systems and will not be discussed. The last three bits of Byte 1 will contain data for the MPAA Movie ratings. This data will be all zeroes if Bits 4 and 3 indicate that TV Ratings are used.

Byte 2 Bit 5 is normally for Violence unless the TV Rating is Y7, then it is for Fantasy Violence. Byte 2 Bit 4 is for Sexual Situations. Byte 2 Bit 3 is for Adult Language. The last three bits of Byte 2 are for the TV Ratings. These bits will be all zeroes if Byte 1 bits 4 and 3 are set for MPAA Movie Ratings.

Bit	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Byte 1	X	1	D	0	1	M2	M1	M0
Byte 2	X	1	(F)V	S	L	T2	T1	T0

Palette Service Menu

The drawing below shows what the OSD looks like when you enter the Palette portion of the Service Menu. You can get to this mode by entering the service mode and pressing the “2” button until the word PALETTE appears in the Adjustment Section. When you get to this section of the menu, you will see an additional word under SERVICE. This word will be one of the Program Palette settings. They are Vivid, Standard, Movie and Sports.

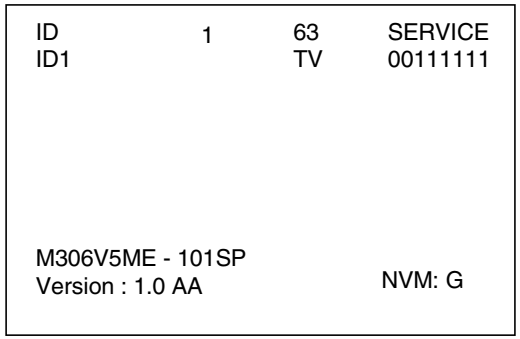


PALETTE SERVICE MENU

This section of the service menu is to set the Reset levels for each of the Program Palette selections. This means that when the customer presses the “Reset” button on the remote in a particular Program Palette mode, that mode’s settings will return to the factory preset. These factory presets are set by entering the service mode and using the Program Palette menu to select the Palette that you want to change. Whichever Palette you select should be displayed under the word SERVICE when you get to the Palette Adjustment Section. The factory preset for each Program Palette setting is listed in the service manual.

ID Menu

The ID Adjustment Section of the Service Menu is used to select the ID features for each model. There are eight different IDs for each model. Besides this, there is some other information displayed at this time.



ID MODE

There are three different lines at the bottom of the screen. The first line at the bottom left shows the type of microprocessor being used. In this case, the type is M306V5ME-101SP. Under that, the version for the firmware is displayed. In this case the Version is 1.0AA. This is useful if a service bulletin is issued that requires the version of the firmware to be checked. The bottom right hand corner of the display shows the state of the NVM. This should say NVM: G as shown above. This is displayed when the Tuning Micon checks certain addresses for certain data. This process confirms that communication is possible between the NVM and Tuning Micon. If this data were not present, it would read NVM: NG.

Tuner Control

Overview

This section will discuss how the Tuning Micon and the tuner work together to receive broadcast and cable signals.

Tuning to a new Channel

When the channel is changed using the Channel keys or the remote control, coarse tuning occurs, followed by fine tuning. **Three things occur during coarse tuning:**

- IC001 Tuning Micon sends data and clock to TU102 Main Tuner
- IC001/51 O-AGCMT outputs a High
- IC001/50 O-Mute outputs a High

The data is used to inform TU102 Main Tuner what station to tune. The High from IC001/51 turns Q1103 ON. When Q1103 turns ON, it lowers the voltage at the RF AGC input of TU102 Main Tuner. This helps the tuner to de-tune so that when the data is read, the tuner can change to the new station. IC001/50 outputs a High which is sent to Q005 Buffer and then to the Mute input of TU102 Main Tuner. The Mute line is used to mute the audio during channel changes.

During fine tuning four things occur:

- IC001/51 O-AGCMT returns to being Low
- IC001/50 O-Mute returns to being Low
- IC001/40 I-AFT is monitored
- Data is sent to fine tune the station

The AGCMT and Mute lines go High because that is their normal state. When High, the AGC is active and the audio is not muted. They will stay in this state until another channel change occurs. IC001/40 I-AFT line is monitored so that IC001 Tuning Micon knows when the tuner is tuned to the station. This is done when IC001 sends data to the tuner to fine tune its internal oscillator for the channel selected. When the oscillator is set correctly, the voltage input to IC001/40 I-AFT will be between 1.7 and 3.5 volts. When fine-tuning occurs, data is no longer sent from IC001 Tuning Micon to TU102 Main Tuner. If there is an open in the AFT line, the tuner will drift above and below the station selected. The result would be a station tuned that would drift in and out between a good picture and a snowy picture.

Auto Programming

During the Auto Program function, which is selectable from the Menu, the set memorizes all channels that have an adequate signal. During this function, IC001 Tuning Micon sends data to TU102 Main Tuner. This data causes the tuner to tune each station one at a time. Also during this time IC001/51 O-AGCMT and IC001 O-Mute will be High, deactivating the tuner's AGC circuit and muting the audio.

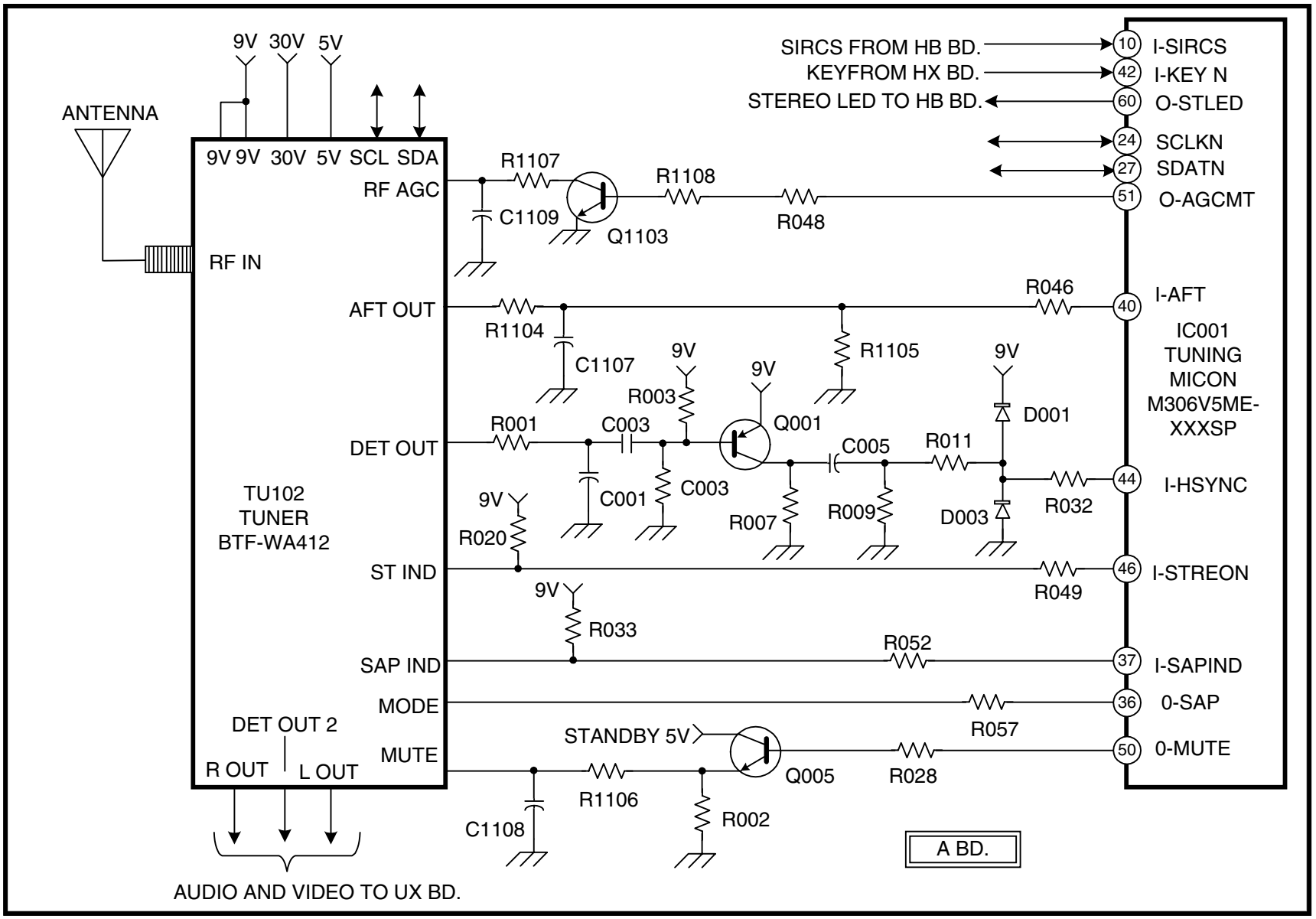
As IC001 Tuning Micon is instructing the tuner to tune each station, it is monitoring its I-HSync input for horizontal sync pulses. If there is a decent horizontal sync pulse present for that channel, then its data is stored in memory and the channel is considered present. This data is stored in the NVM when the set is turned OFF.

The sync separator works by taking the video signal from the Detect Out of TU102 Main Tuner and separating the horizontal sync tips and applying that signal to Q001/B. Q001 inverts these signals and outputs them from its collector. The signal here will be positive going horizontal sync pulses. These are applied to IC001/44 I-HSync.

Auto SAP (Secondary Audio Program)

All models that use the AA2U chassis have the Auto SAP feature. This feature will automatically output the secondary audio if it is present and Auto SAP is selected in the menu. If there is no secondary audio, the Main audio will be used.

When Auto SAP is selected, IC001/36 O-SAP outputs a High to the Mode input of TU102 Main Tuner. Anytime a SAP signal is received by the tuner, regardless of the Auto SAP setting, the SAP IND line of TU102 Main Tuner outputs a High.



TUNER CONTROL

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Video Path Block

Composite Video

Composite video signals are input to A/V Switch where the selected input is switched out. This output is used for the Monitor Out and is also sent back into the A/V Switch. Data from I^2C bus will determine whether this video or the signal from the Y inputs is selected. The selected signal is then output from the A/V Switch.

S Video

The Y and C signals from the S video jacks are input to the A/V Switch. The Y and C inputs are switched directly out of the A/V Switch for normal Main Video processing. They are also combined and output as composite video at the same point where the composite video is output. This signal is sent to the Monitor Out jack.

Comb Filter

IC3504 is a 3D Comb Filter. This means that it separates the Y and C signals in a composite video source by comparing the line it is processing with the line above and below it, and also with the same lines in the previous and upcoming frame. This provides the ultimate in Y and C separation, avoiding dot crawl and other unwanted effects.

After processing by the Comb Filter, the Y signal becomes known as Comb Y. Comb Y is sent back to the A/V Switch which selects between Comb Y and Video 4 Y. The input chosen is switched out of the A/V Switch and becomes Main Y.

ID 1 Decoder (FV26 only)

The Comb Y signal is also sent to the ID 1 Decoder in the FV 26 models. ID 1 is a system where the video signal contains data that is “hidden” in the vertical blanking area. This data is similar to Closed Caption data and contains information about the aspect ratio of the picture. The “FV26” model sets contain an ID 1 Decoder that is used to determine if the video being received is 16:9. If it is and the user has selected the Auto Aspect Ratio in the Menu, the set automatically switches to that mode.

Video 4 Component Input

The Pb and Pr signals are sent directly to the YUV Switch circuit on for Main Video and to the PIP circuit. The Y signal is also input to one of the Y inputs of the A/V Switch. When selected, it is output from the A/V Switch to the Comb Filter circuit and then directly out to the Main Y output of the A/V Switch. The signal sent to the Comb Filter will only be used for ID 1 detection and V Chip detection. The Video 4 Y signal will be output from the A/V Switch and sent to the YCJ for use by the sync circuits. **Note**: There is no Monitor Out signal available when using the Component Video inputs.

Main Video

If the main Y and C signals are from the Tuner or Video 1-3, they are input to the YCJ. The YCJ decodes these signals and outputs them as YUV to IC352 YUV Switch. The Main Y signal is also input to the Tuning Micon for V Chip and CC Data.

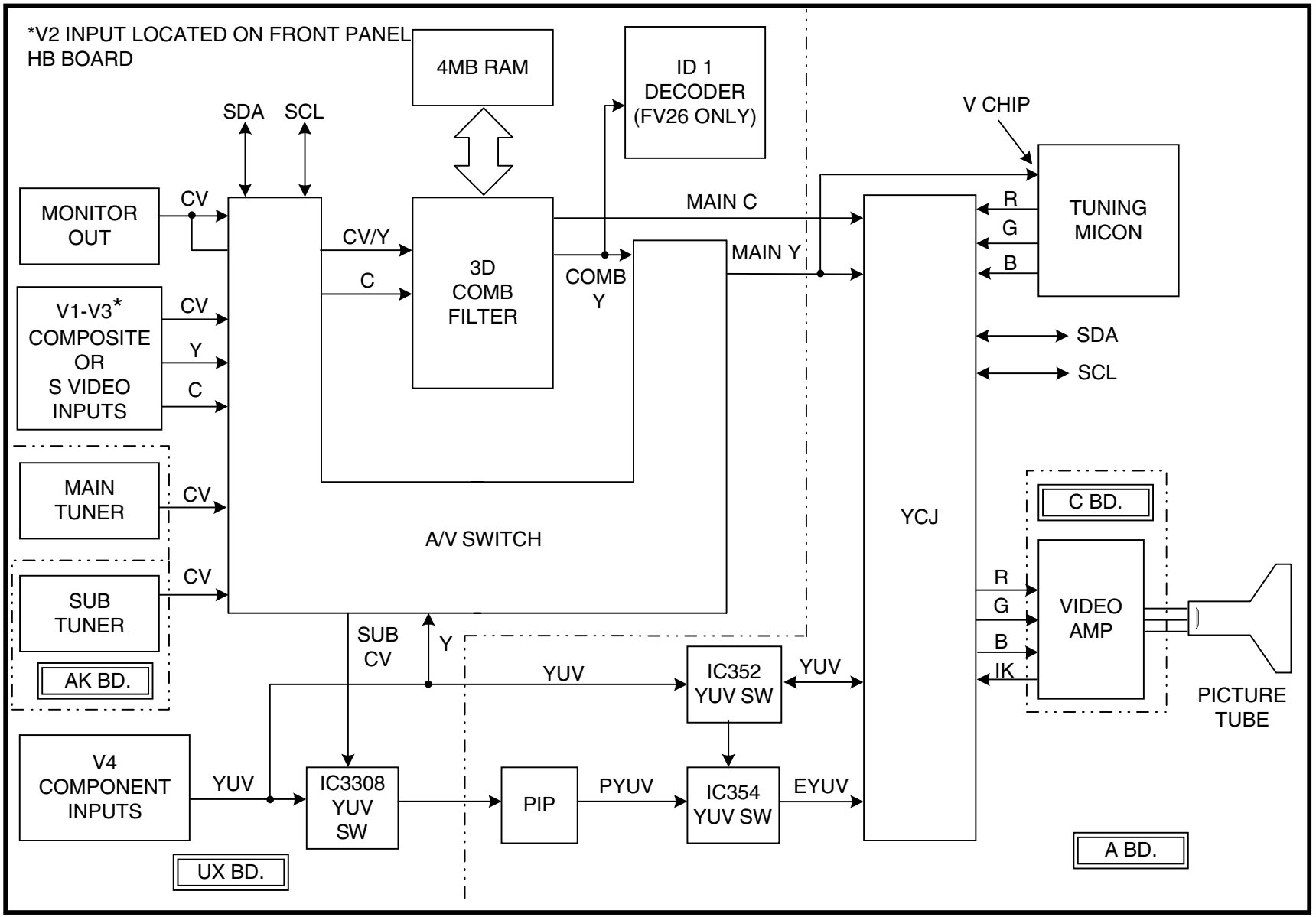
If Video 4 input is selected, the Main Y signal will be used for V Chip and sync creation purposes only. The YUV signals from the Video 4 input will be input to IC352 YUV Switch.

The main picture comes from YUV signals decoded from Main Y and C, or from the Video 4 component input. IC352 YUV switch selects between these two sources. This picture is either switched directly to the YCJ or mixed with the PIP signals and sent to the YCJ. The signal that is sent to the YCJ is output after processing as RGB.

PIP

The AA2U chassis includes two-tuner PIP in all models except for the KV-36FS12. The PIP IC is capable of creating a child picture from all of the sources, including the Video 4 component input. The child picture can be placed in any of the four corners of the screen in two different sizes.

Sub video from any of the input sources, except Video 4, is output from the A/V Switch to the IC3308 YUV Switch. IC3308 YUV Switch selects between the Video 4 Component video inputs and the Sub Video composite input from the A/V Switch. The signal selected is sent to the PIP inputs. The PIP inputs accept either component or composite inputs. The PIP section compresses the sub video and outputs YUV and a switching signal to IC354 YUV Switch. These signals will be mixed with the Main Video signals and output to the YCJ.



VIDEO BLOCK DIAGRAM

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Video Switching and Comb Filter

Overview

This section will cover the operation of the video switching and comb filter. These circuits are located on the UX board. The UX board also contains the A/V jacks. The video switching circuit controls all switching for composite, S Video and component video inputs. The comb filter separates the Y and C from the composite video inputs. It also is used for Y and C noise reduction as well as other video processing.

Video Switching

There are three types of video that can be input to the set. They are composite, S video and component video. The composite, S video and component Y signals are applied to the various inputs of IC261 A/V Switch.

Composite Video

Composite video signals input to IC261 A/V Switch are switched to pin 53. This output is used for the Monitor Out from J234 and is also sent back into IC261 at pin 49. Data from IC001 Tuning Micon will determine whether this video or the signal from the S Video Y inputs is selected. The selected signal is then output from IC261/56 Y Out 1. It is important to remember that this signal could be only Y in other modes.

S Video

The Y and C signals from the S video jacks are input to IC261 A/V Switch. The Y and C inputs are used for normal processing and the Monitor Output. The Y and C signals are combined and output at IC261/53. This signal is sent to J234 and back into IC261/49. The signal at IC261/49 is not used when there is an S video input.

When one of the S Video inputs is selected, Y will be output from IC261/56 Y Out1. The corresponding C signal will be output at IC261/58 C Out1. Both signals are sent to the Comb Filter circuit.

Component Video

The Pb and Pr signals are sent directly to the YUV Switch circuit on the A board for Main Video and to IC3303 PIP. The Y signal is coupled to one of the Y inputs of IC261 A/V Switch. If selected it will be output IC261/56 Y Out1 to the Comb Filter circuit.

Note: There is no Monitor Out signal available when using the Component Video inputs.

Y Switch

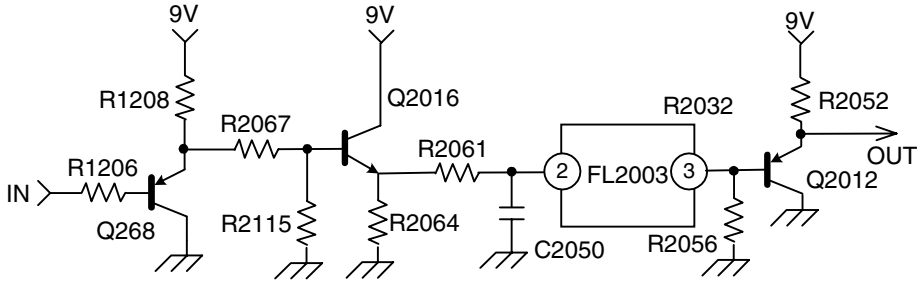
After processing by the Comb Filter, the Y signal is returned to IC261/27 Y5 Input. It is then output to two places. The first is IC261/35 V Out3. This signal becomes the Main Y signal. The second is IC261/42 V Out2 is used for sub video (PIP). This pin will always have a composite video signal output from it. If an S Video source was input, this Y signal would be combined with its corresponding C input causing a composite video signal to be output here. If the signal is from the sub tuner, it will also be composite.

Comb Filter

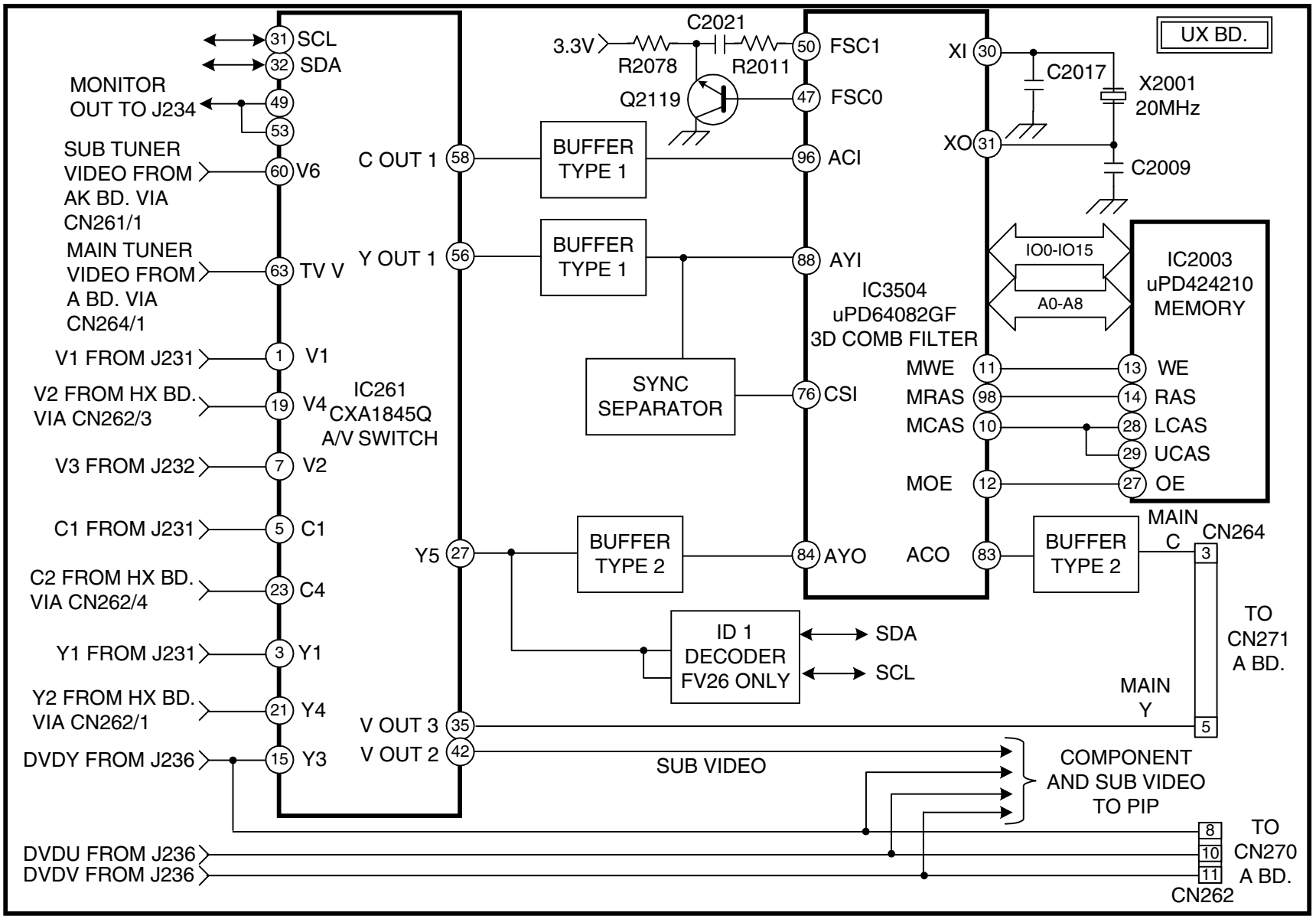
When a composite video signal is selected, IC261/56 Y Out sends composite video to the Comb Filter circuit, IC3504/8.

Buffer Type 1

The first portion of the Comb Filter circuit is a Buffer. We will call this Buffer Type 1. A similar circuit is also used for the C output from IC261 A/V Switch. This will be covered later.



BUFFER - TYPE 1



VIDEO SWITCHING AND COMB FILTER

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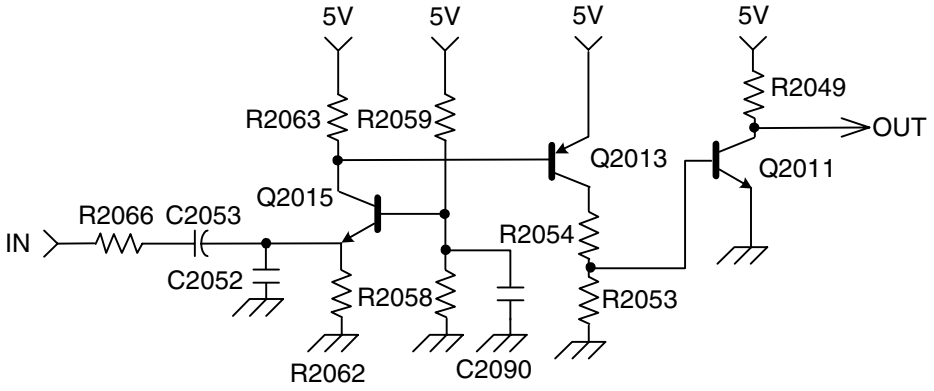
The purpose of this circuit is a low pass filter used to buffer and filter the Y or composite video signal. It rolls off the high frequencies present in the video signal to avoid artifacts that could be created if they were input to IC3504 3D Comb Filter.

The circuit shown shows two emitter follower buffer circuits that are used to increase the amount of current present in the signal so the signal will not be completely reduced by FL2003. FL2003 is a low pass filter that passes all signals below 6 MHz. This provides anti-aliasing for the A/D converter. The filtered signal is then sent to another emitter follower, Q2012. Its output is sent to the sync separator and then goes directly into the Comb Filter at IC3504/88 AYI.

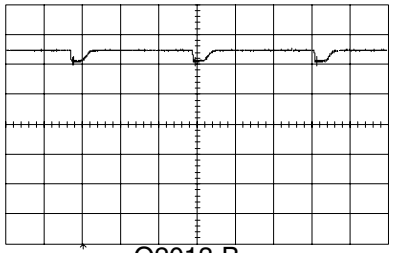
Sync Separator

The sync separator is used to extract the sync signals from the composite video. This is necessary because the A/D Converter in IC3504 Comb Filter needs the horizontal sync component to clock in the individual horizontal lines.

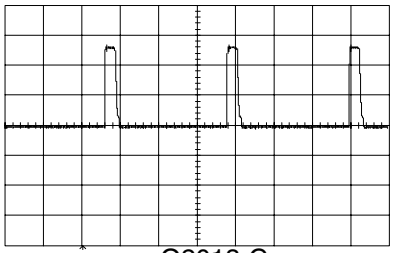
The video signal is input to the emitter of Q2015 through R2066 and C2053. Q2015 is a common base amplifier used to extract the sync tips from the video signal. The sync tips are then input to Q2013. Q2013 is an inverter and is also used to make the extracted sync signal 5 volts peak to peak. The signal is then applied to another inverter, Q2011. The signal is inverted again because IC3504 Comb Filter requires a negative going sync pulse at its input.



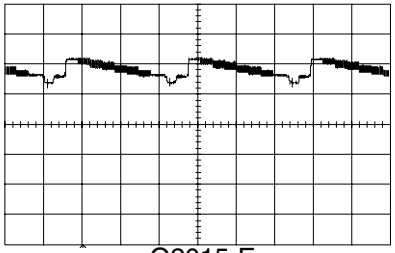
SYNC SEPARATOR



Q2013-B
2V 20us



Q2013-C
2V 20us

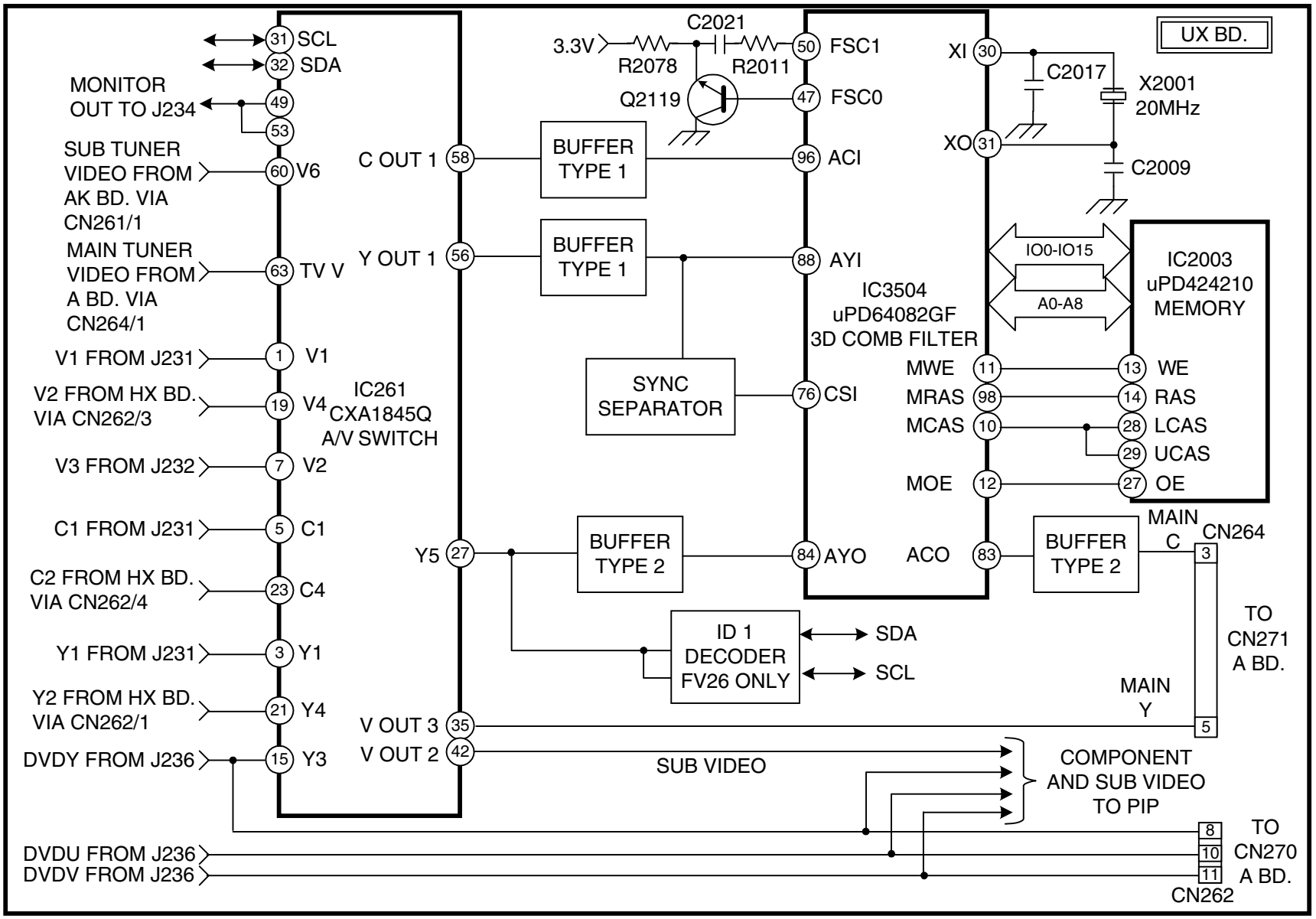


Q2015-E
2V 20us

3D Comb Filter

IC3504 is a 3D Comb Filter. This means that it separates the Y and C signals in a composite video source by comparing the current with the line above and below, and with the same lines in the previous and following frame. This provides the ultimate in Y and C separation, avoiding dot crawl and other unwanted effects.

IC3504 3D Comb Filter takes the composite video input from pin 88 AYI and digitizes it using its own built in A/D converter. This A/D Converter uses the composite sync input at pin 76 CSI as a clock. The IC then evaluates this digitized signal for motion. It separates the Y and C and they are sent through a variety of noise reduction stages. The separate Y and C signals are output at pin 84 and pin 83, respectively.



VIDEO SWITCHING AND COMB FILTER

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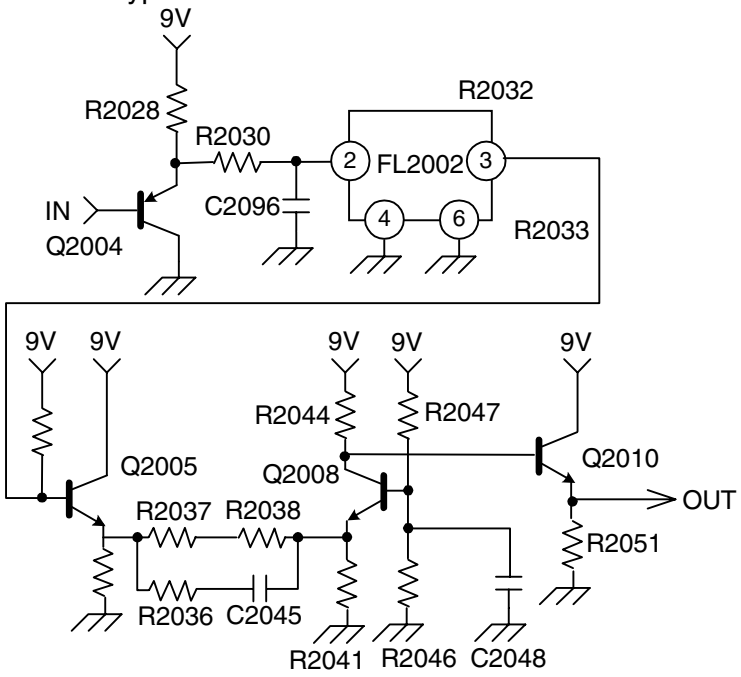
In order to process the signal in this way, IC3504 3D Comb Filter works in conjunction with IC2003 Memory. IC2003 Memory is 4 MB of fast RAM used specifically for video applications. IC3504 3D Comb Filter has a built-in memory controller that controls the reading, writing and refreshing of IC2003 Memory using the WE, CAS, RAS, and OE lines. It also uses 9 address lines and 16 data lines for sending data back and forth between itself and the Memory IC.

If the input selected was an S Video source, then Y and C would already be separated. In this case the signals that are input to IC3504 at pins 96 ACI and 88 AYI are sent directly to the noise reduction section of IC3504. After processing, these signals are output from pin 84 AYO and pin 83 ACO.

Buffer Type 2

After the Y and C signals leave the Comb Filter, they are input to similar buffers. We will call these buffers Type 2. They contain the same low pass filter as the Type 1 buffer.



BUFFER - TYPE 2

The signal from the Comb Filter is input to Q2004/B. Q2004 is an emitter follower. The output from the emitter of Q2004 is input to FL2002. FL2002 is a low pass filter used to roll off all frequencies above 6 MHz.

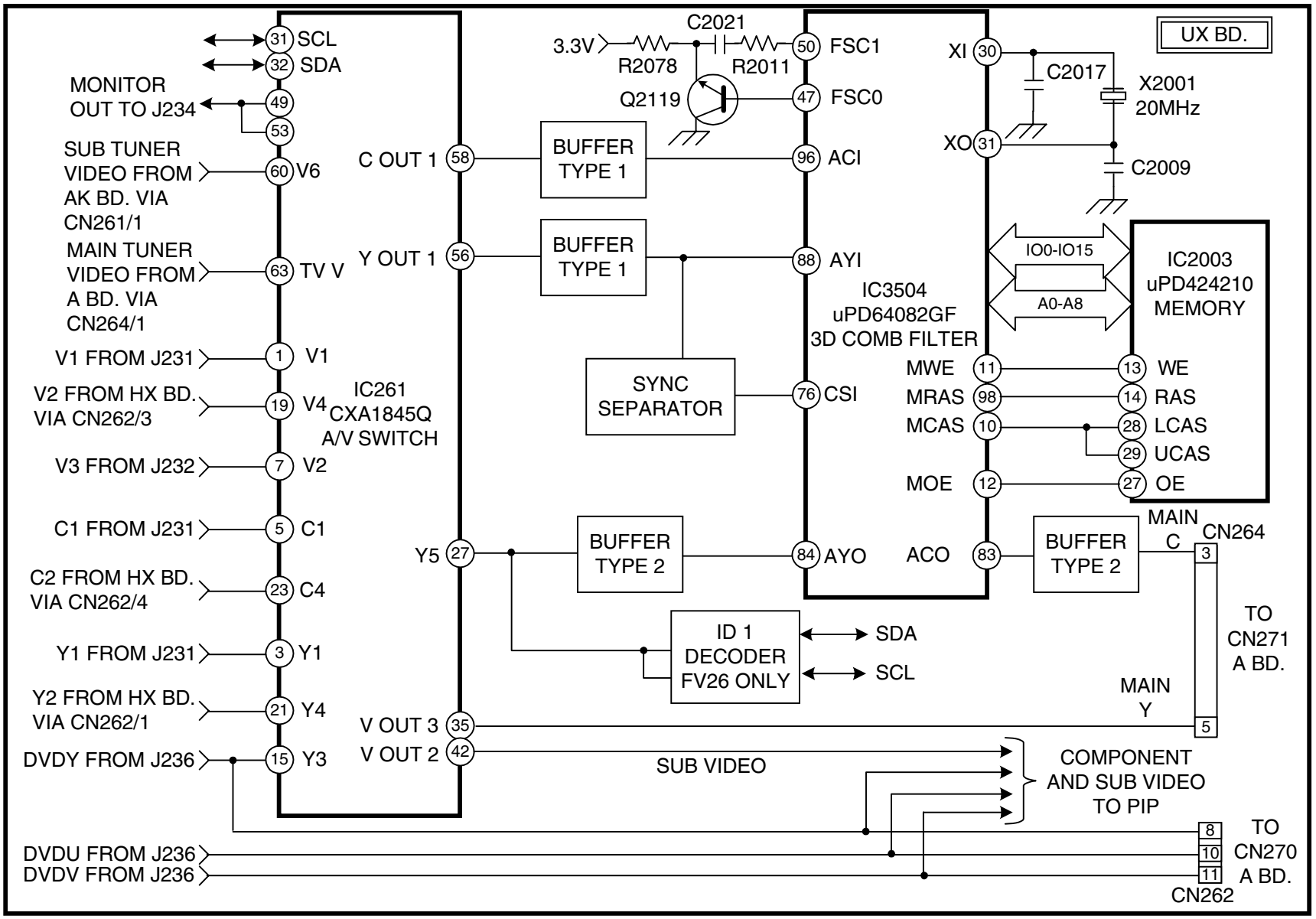
The signal is then input to a differential amplifier consisting of Q2005, Q2008 and associated components. This design reduces noise that may have been picked up from other sources inside the set. The signal is output at Q2008/C and input to the base of Q2010. Q2010 is another emitter follower type buffer.

After it is buffered, the C signal is output to CN264/3. CN264 is connected to CN271 on the A board. This C signal will now be called Main C. The Y signal is sent back to IC261 A/V Switch and also to IC2009 ID1 Decoder after it is buffered and filtered. The signal input to IC261/27 Y5 is output at IC261/35 V Out3. The signal is now called Main Y and is applied to CN264/5.

ID 1 Decoder

ID 1 is a system wherein the video signal contains data that is "hidden" in the vertical blanking area. This data is similar to Closed Caption data and contains information about the aspect ratio of the picture. The "FV26" model sets contain an ID 1 Decoder that is used to determine if the video being received is 16:9. If it is, the set automatically switches to that mode.

IC2009 ID 1 Decoder is an IC that looks at the data in the vertical blanking area. If it receives data that indicates a 16:9 picture, it sends data via the I^2C bus to IC001 Tuning Micon (not shown). IC001 Tuning Micon would send data via I^2C to the YCJ (not shown) to automatically switch the aspect ratio of the picture to 16:9 compressed mode. In the compressed mode the set will show all 480 active lines in a vertically smaller space. This increases the vertical resolution and is also closer to what was actually seen in a film version of a movie. This 16:9 format has become very popular in DVD movies and it will be discussed later in this book.



VIDEO SWITCHING AND COMB FILTER

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PIP

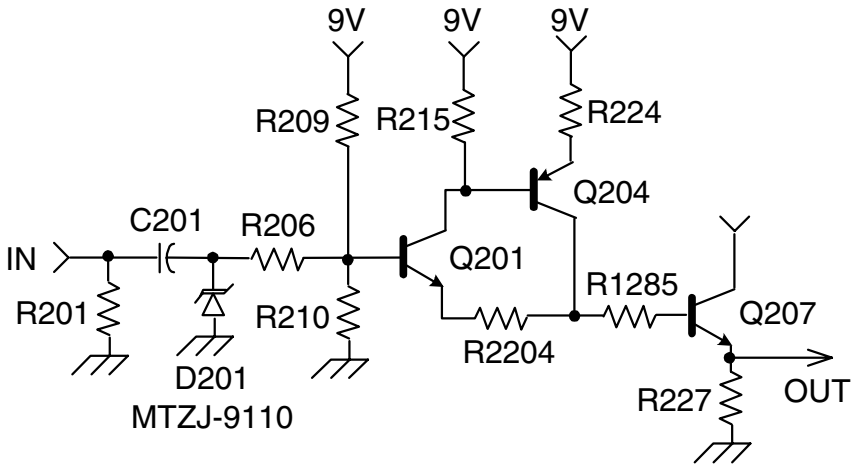
Overview

The AA2U chassis includes two-tuner PIP in all models except for the KV-36FS12. The PIP IC is capable of creating a child picture from all of the sources, including the Video 4 component input. The child picture can be placed in any of the four corners of the screen in two different sizes.

Inputs

Sub video from any of the input sources, except Video 4, is output from IC261 A/V Switch to Q3301 Buffer. Q3301 is an emitter follower and buffers the composite video signal from the A/V Switch. This signal is input to IC3308/2 Y In. IC3308 is a YUV switch.

All the video 4 input signals are buffered by similar circuits. This is to ensure that the signals have adequate current to supply their loads. This buffer consists of Q201 and Q204. They provide a high current gain for the incoming component video signal. The signal is then buffered by Q207 and output from the emitter to the inputs of IC3308 YUV Switch.



COMPONENT VIDEO BUFFER

IC3308 YUV Switch

IC3308 YUV switch is a CMOS switching IC. This IC is able to switch between two sets of three inputs and output them to three outputs. Each of the three switches has its own control line at pins 9, 10 and 11. These three lines are tied together so that all three switches are used in unison.

When the Video 4 input is **not** selected, the control voltage from IC1001 D/A Converter on the A board is 0 VDC. The D/A Converter receives data from the I^2C bus and sets the appropriate voltage at IC1001/3 DVDSW2. When the Video 4 component input is selected, the control line goes High. This causes the switches in IC3308 to select the component inputs.

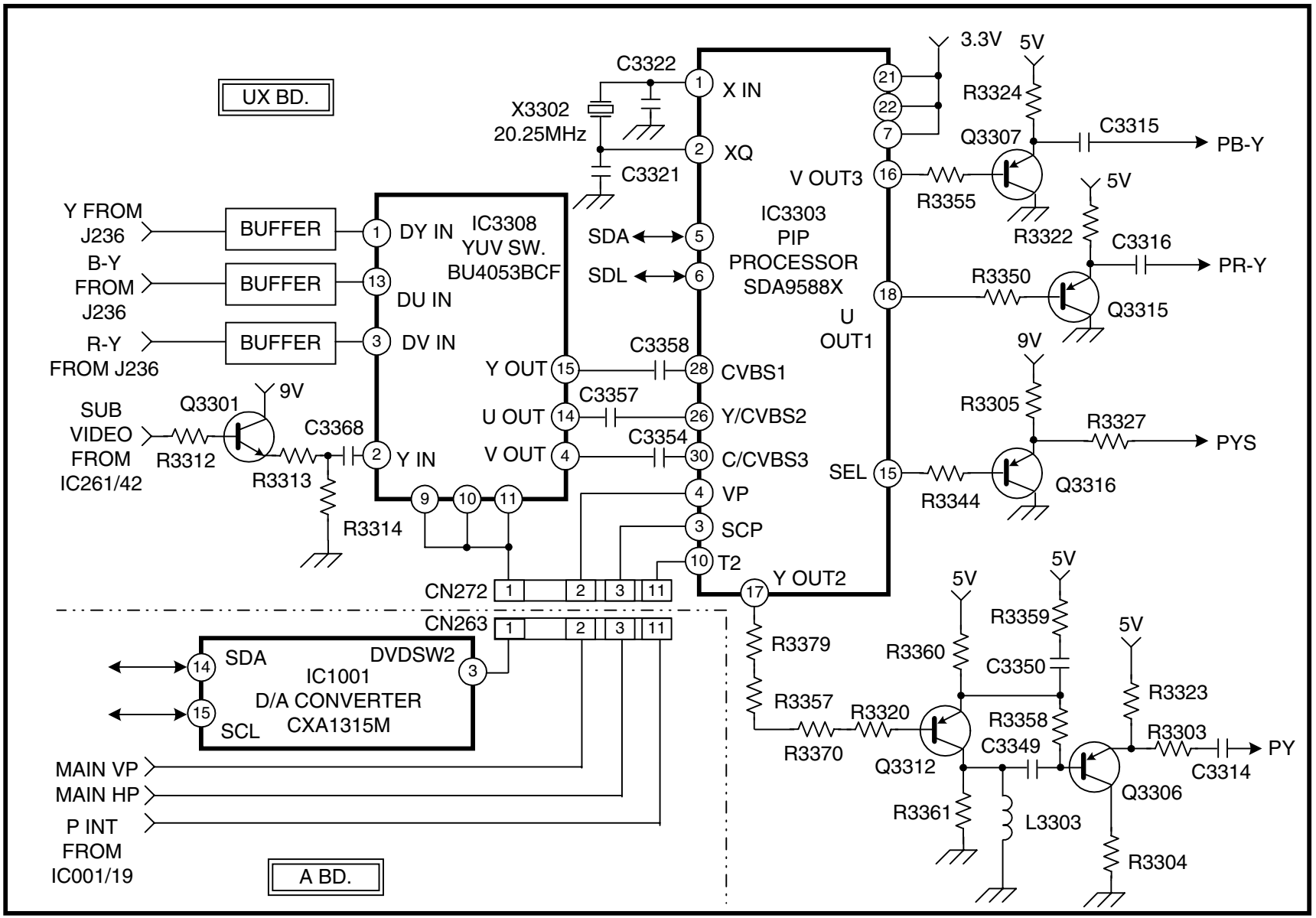
IC3303 PIP

IC3303 PIP is single chip picture-in-picture processor that incorporates three inputs that can be either composite or component video. These inputs are located at IC3303/26, 28 and 30. Pin 28 can be a composite or a Y signal. Pin 26 will be U only and pin 30 will be V only.

IC3303 PIP uses a clock created by X3302 along with vertical and horizontal pulses input to IC3303/4 and 3 respectively, to clock the A/D conversion and other digital operation inside the IC. The picture is compressed in the digital domain, converted to analog and output as YUV. These signals are output from IC3303/17, 18 and 16.

This compressed sub picture can be 1/9th or 1/16th the size of the main picture. A high-speed video switching circuit is used to create the signal at IC3301/15 SEL. This signal is a series of pulses that determine where the PIP window appears on the screen and what size it will be. IC3303/10 T2 is used to freeze the present video frame when a Sub Tuner channel change is initiated.

Additionally IC3303 PIP is 16:9 compatible. This means if you are in the 16:9 mode the PIP window will also have a 16:9 aspect ratio. IC3303 PIP also contains the acquisition and filtering circuits necessary to extract closed captioning and V Chip rating data. When a blocked signal is detected in the sub video, the PIP window will go black and a lock icon will appear next to the sub channel in the OSD. There is no Closed Caption function for the Sub Picture.



PIP

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Video Processing

Overview

The main picture comes from either the switching circuit's Main Y and C, or from the Video 4 component input. The YUV switch selects between these two sources. This picture is either switched directly to the YCJ or mixed with the PIP signals and sent to the YCJ. The signal that is sent to the YCJ is output after converting to RGB.

Main Picture

The Main Y and C signals from the Switching and Comb Filter circuits are input to IC355/7 and 9. These Y and C signals are decoded to their component form. They are output from IC355/30 B-Y Out, IC355/31 R-Y Out and IC355/32 Y Out. The R-Y and B-Y signals are each buffered and input to IC352/22 and 21 respectively.

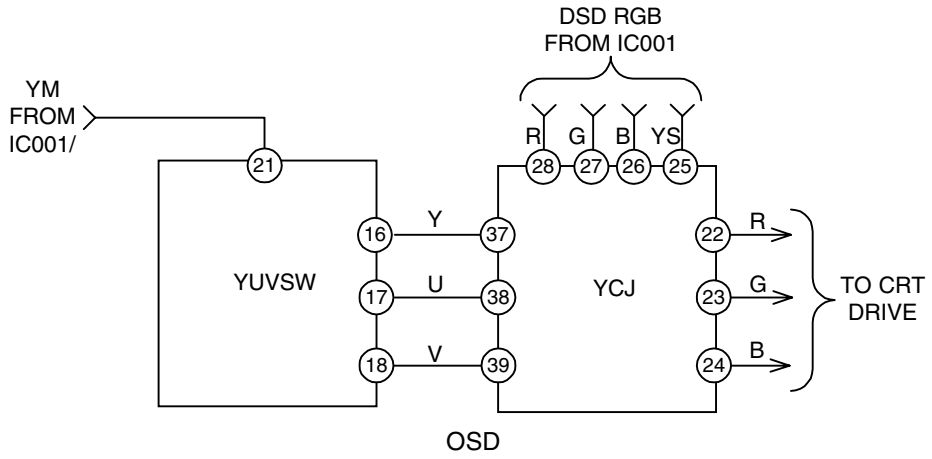
The Y signal is input to IC353/1 Y In. This IC is a picture improvement IC that outputs the velocity modulation signal and performs gamma correction. This improved Y signal is output from IC353/17. It is buffered by Q313, an emitter follower, and input to IC352/19 TV In.

IC352 YUV SW is used to switch between the Video 4 component inputs and the inputs at IC352/19, 21 and 22. Switching is controlled by pins 6 and 13. These pins receive a High or Low from IC1001 D/A Converter. The outputs from IC1001 are dependent on the data it receives over the I^2C bus. Pins 6 and 13 will be Low when any input except Video 4 is selected.

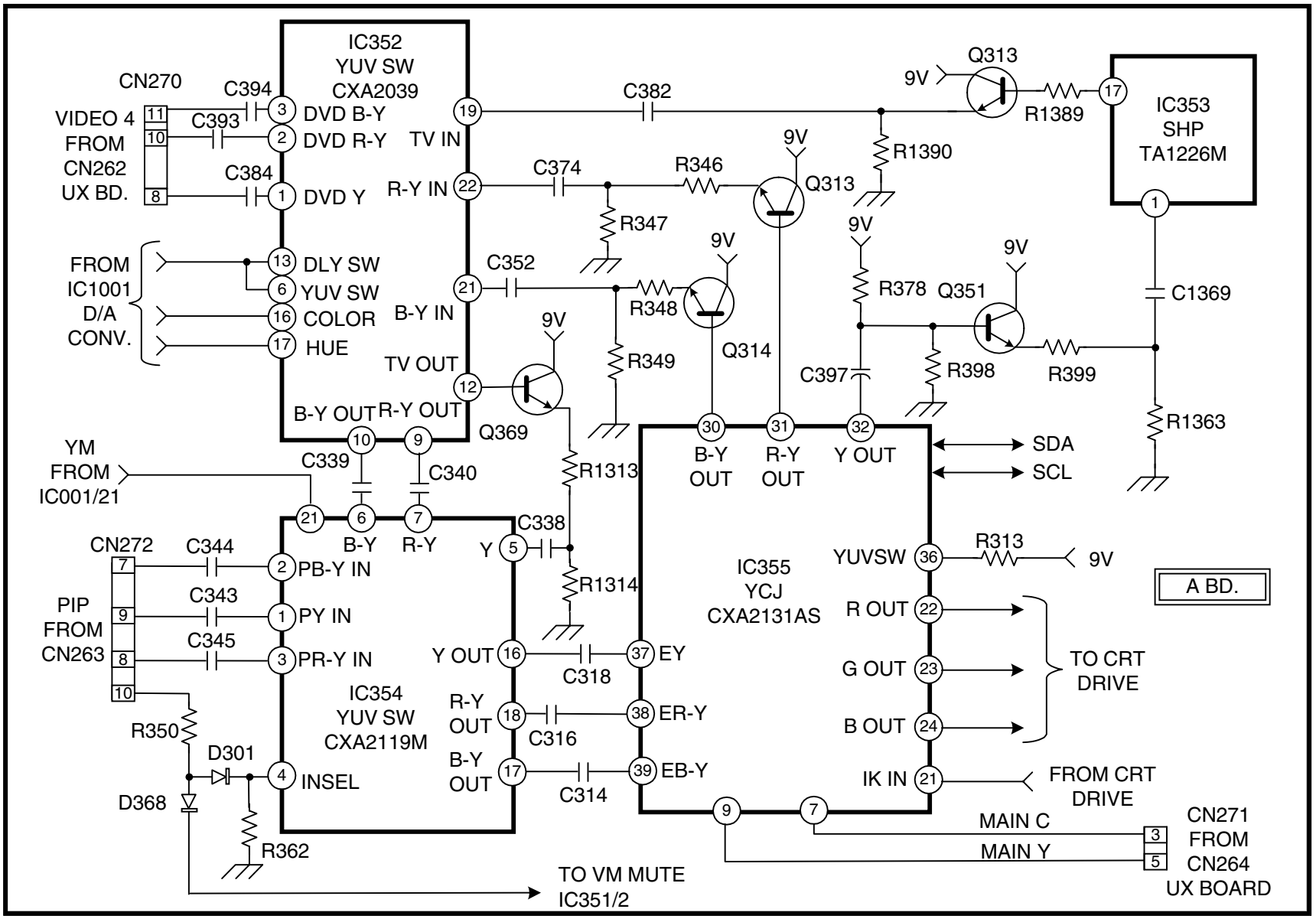
The selected signals will be output from IC352/9, 10 and 12. These signals are input to IC354 YUV SW at pins 5, 6 and 7. IC354 YUV SW is a color difference interface that will be responsible for using the SEL signal from the PIP circuit to mix the compressed PIP picture with the main picture. The PIP video signals are input into IC354/1, 2 and 3. When only the main picture is to be displayed, IC354/4 INSEL will be Low. When PIP is to be inserted into the main picture, the input at pin 4 will be low with a series of pulses that set the size and position of the PIP window.

Whether the signal is just the main picture or the main picture with the PIP picture inserted, it will be output as Y, B-Y and R-Y at IC354/16, 17 and 18. These signals are input to the EY, EB-Y and ER-Y of IC355 YCJ. These inputs have been used in previous models for the PIP picture. In this case, video from all inputs is sent through these inputs. This is because IC355/36 YUVSW is tied to the 9-volt line through R313.

These signals are then processed by IC355 YCJ. The adjustments done at this point can be seen by looking at the VP section of the Service Menu. They include drive, cutoff, sub-brightness, sub-sharpness, DC transmission level and others.



The OSD circuit works slightly differently than we have seen in the past. The RGB signals from IC001 Tuning Micon are still input to IC355 YCJ. The YS signal is also sent to IC355 YCJ. The YS signal is responsible for the position of the OSD. It switches the video signal to a black level and inserts the OSD into that black level. The YM signal is input to IC354 YUV SW at pin 21. The YM line is used to lower the video level at an area where the OSD will go. You can see this if you use the Customer Menu while viewing a program. You will notice that you can still see video under the OSD area, but it is a lower video level. It appears as a gray box over that particular section of video.



VIDEO PROCESSING

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CRT Drive

Overview

This section describes how the RGB signals are displayed by the picture tube. In addition, we will discuss the IK/AKB circuit and how it functions in the AA2U chassis. Troubleshooting no video problems by using the IK pulses output by the YCJ will also be covered.

IK Pulses and Video Blanking

When the set is turned ON and communication is established between the YCJ and the Tuning Micon, IK pulses are output for each color. These pulses are one horizontal line in duration and occur once during every field. They are output so they occur on consecutive lines with red first, followed by green and blue. They are buffered by Q304, Q305 and Q306 and applied to CN1761.

CN1761 is connected to CN351 on the C board. The RGB signals that are applied to the C board are input into pins 1, 2 and 3 of IC702 CRT Drive through resistors R1751, R1752 and R1753. IC702 amplifies and inverts these signals, and applies them to the cathode of the tube for their respective colors. If the tube is biased correctly, no lines will be visible as the cathodes output occurs in the overscan area of the picture tube.

IC702/5 IK outputs a voltage signal that represents the amount of total current being drawn by each cathode. Since each color is outputting a pulse for one H line, in every field we would see a waveform like that shown below at Q310 or Q311 Base. It is very hard to see this waveform at other places so it is recommended that you only check IK return here. Place your scope in delayed mode and highlight the area that appears to be one pulse. Expand it and you will see that there are three distinct pulses, one for each color. Your scope should be set to 5ms per division. Some may have trouble triggering on these signals.

Once the IK detect circuit in the YCJ detects that the proper current is flowing to each cathode, the video is unblanked and a picture may be seen. The YCJ continues to monitor the IK IN line for the proper signal levels. If there is a failure during operation, the Standby/Timer LED will flash in sequences of five.

Tube Bias

The CRT requires high voltage and other biasing voltages to properly display a picture. It requires a heater voltage, which is developed by the FBT (not shown) on the A board. The heater is necessary to heat the cathode so that it can emit electrons. If it is missing, the cathode will not emit electrons and consequently there would be no picture.

The G1 input on the tube is a control grid. There are three separate pins on the tube for G1. They are pins 6, 9 and 13. These pins are connected together and tied to ground through R1794. There is approximately -.01 volts present at these pins when no video is input. There is also a reversed biased diode, D1792, across R1794. This is a protection diode used in case of arcing.

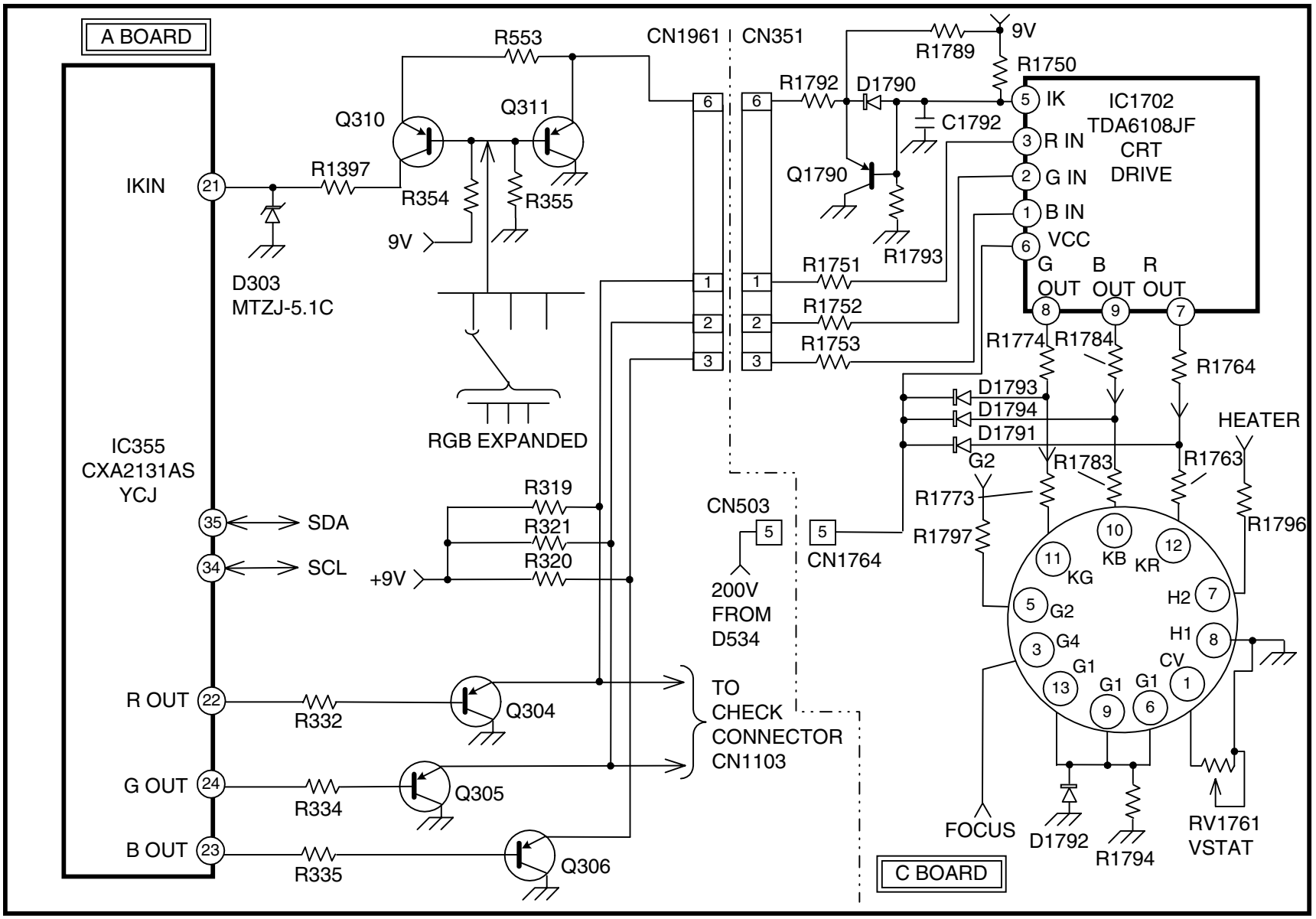
G2 is also a control grid and is used to limit the acceleration of electrons as they travel through the neck of the tube. These changes in the acceleration of the beam change the picture brightness. Inputting a gray scale pattern and adjusting the G2 VR on the FBT (not shown) so that the darkest bar is completely black sets G2. This is done with Contrast set to max and Brightness set to the midpoint.

Pin 3 is G4 and it is for the electrical focus control VR on the FBT. It should be set for optimum focus using a dot pattern.

Pin 1 of the tube CV is used for convergence. The convergence plates in the tube align the colors to each other using this voltage.

Troubleshooting

The first step in troubleshooting is to determine if there is a tube bias problem or an IK blanking problem. You will know if you are in video blanking if the Standby/Timer LED flashes continuously or flashes in sequences of five soon after turn ON. See if the YCJ is outputting a pulse for each color. If there is communication between the YCJ and Syscon, these pulses should be output. Their amplitude should be between 1 and 4 volts peak to peak. If one of these pulses is missing at the RGB outputs of the YCJ, replace it. These same pulses should also be present at the RGB inputs of IC702 on the C board. If the inputs to IC702 CRT Drive are good there should be an output.



CRT DRIVE

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Self-Diagnostics

Overview

The AA2U chassis uses self-diagnostics that differ from previous models. This section will discuss what those differences are and how to use various key indicators to diagnose problems.

The AA2U chassis uses combinations of blinking Standby/Timer LED and Stereo LED statuses to indicate failures. As in other chassis, the Standby/Timer LED will blink during Vertical and AKB failures. These are indicated by the Standby/Timer LED flashing in sequences of four for a vertical failure indication, and flashing in sequences of five for AKB failure indication. The set does not shut down during these failures. This allows for some troubleshooting when a failure occurs. This information is also logged in IC002 NVM.

When the set is first turned ON, a Power Supply failure would be indicated by the Standby Timer LED flashing three times, then turning off, and then the Stereo LED coming ON. These problems are also accompanied by the Power Relay turning OFF due to the latch circuit being activated.

The Standby/Timer LED flashing three times at Turn ON then turning OFF and the Stereo LED remaining OFF indicate loss of I^2C data. The set will have no other functions if this occurs.

AKB Failure

The purpose of the AKB circuit is too ensure that the white balance that was set up at the factory is maintained. Sending a one-H pulse for each color during the vertical blanking interval from the YCJ does this. The current drawn by the tube during the time these pulses are generated is fed back to the YCJ and it adjusts the drive levels for each color to maintain the correct white balance. If the correct white balance cannot be obtained, the YCJ indicates this to the Tuning Micon via the I^2C bus. The Tuning Micon would then pulse the Standby Timer LED so that it flashes in sequences of five. In this set, unlike other Sony sets, the video will **not** be blanked at this point. After 11 seconds the picture will appear and be discolored because one or more of the tubes cathodes are not operating correctly.

Vertical or Horizontal Failure

Vertical failure is detected by sending the pump-up pulses from IC561/6 to a sample and hold circuit. This circuit outputs a HIGH to IC355/15 VM Out/V Protect. This pin is used only for vertical protection in this set and not for Velocity Modulation. If a fault occurs that causes the pulses at IC561/6 to disappear, the sample and hold circuit would pull IC355/15 down to a LOW. This would cause IC355 YCJ to blank the video outputs and alert IC001 Tuning Micon that a vertical failure has occurred. The Tuning Micon will pulse the Standby Timer LED so that it flashes in sequences of four.

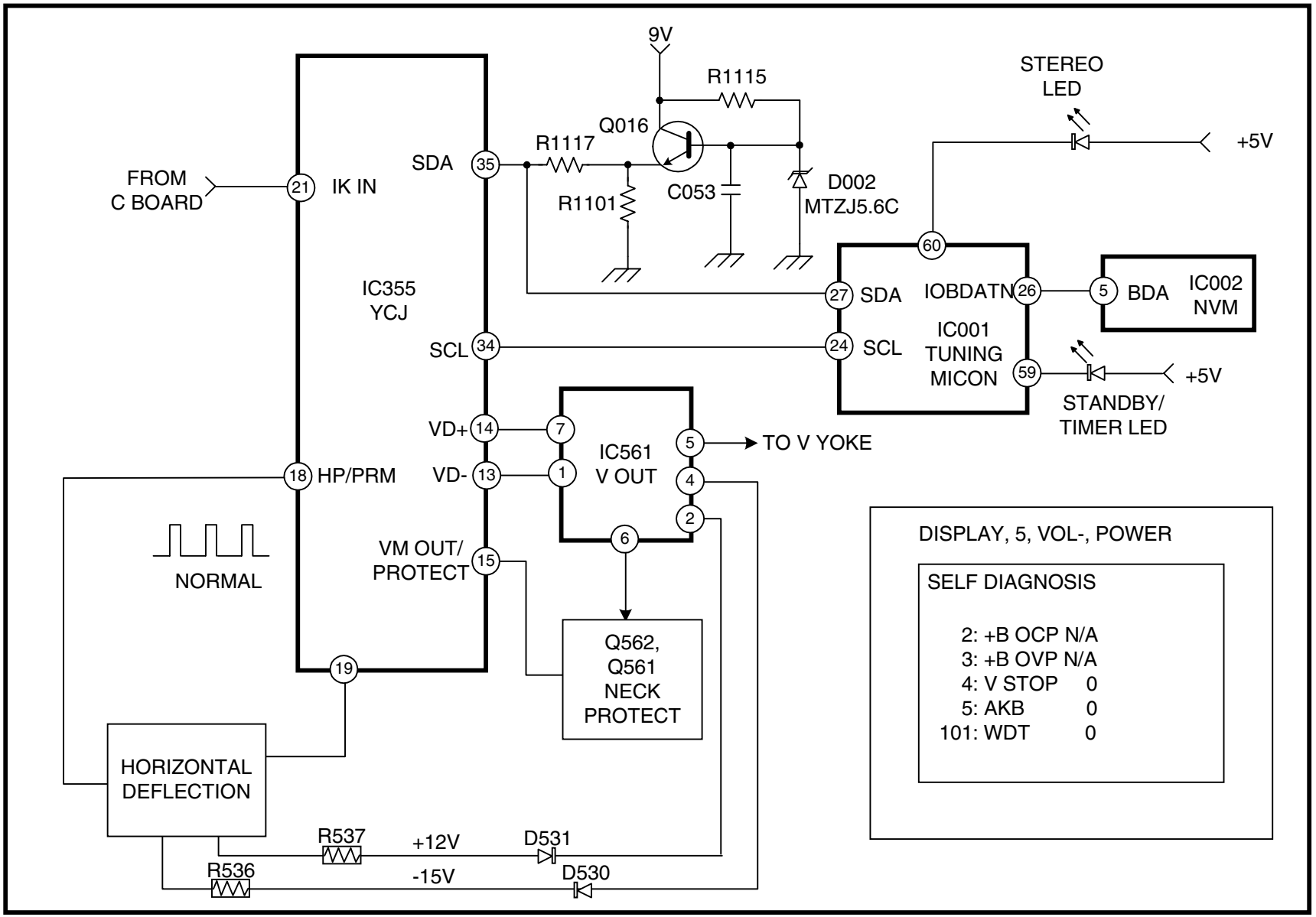
If the vertical failure were intermittent, the picture would return when the circuit started working again. However, the Standby/Timer LED would continue the flash as it did when the vertical failure occurred. If a customer complains about an intermittent picture, ask how many times the Standby/Timer LED is flashing.

If horizontal failure occurs then no HP pulse will be sent to IC355/18 HP/PRM. When this line goes LOW, the HD signal from IC355/19 is disabled. This causes the horizontal circuit to shut down. Since rectified signals from the FBT are used to create the +12 and –15 volts that supplies the vertical output, loss of horizontal will cause vertical failure to be indicated.

Once a horizontal shutdown occurs, the set cannot return to normal operation until it is turned OFF and then back ON. This is because once the HD is removed because of a LOW on the protect line, it will not be restarted until power is cycled to the YCJ.

Troubleshooting Horizontal or Vertical?

Problems with the horizontal or vertical circuits can cause a vertical failure to be indicated by the Self-Diagnostics. Two indicators that point to the horizontal circuit are lack of High Voltage and lack of heater filaments glowing. It is often difficult to determine by listening or looking whether there is High Voltage present or if the heaters are glowing. If you are unable to determine if these things are present, check the following to determine which circuit is at fault:



SELF-DIAGNOSTICS

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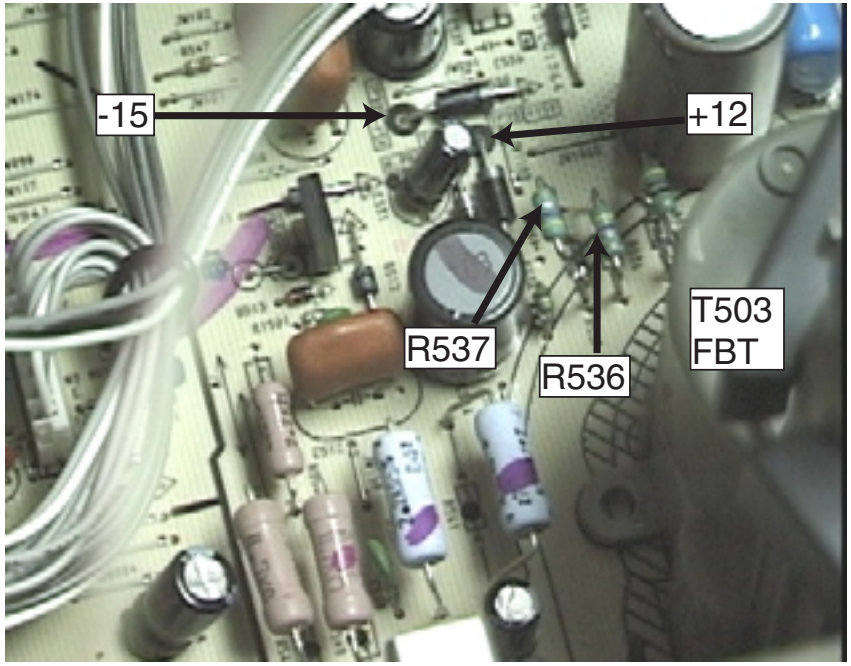
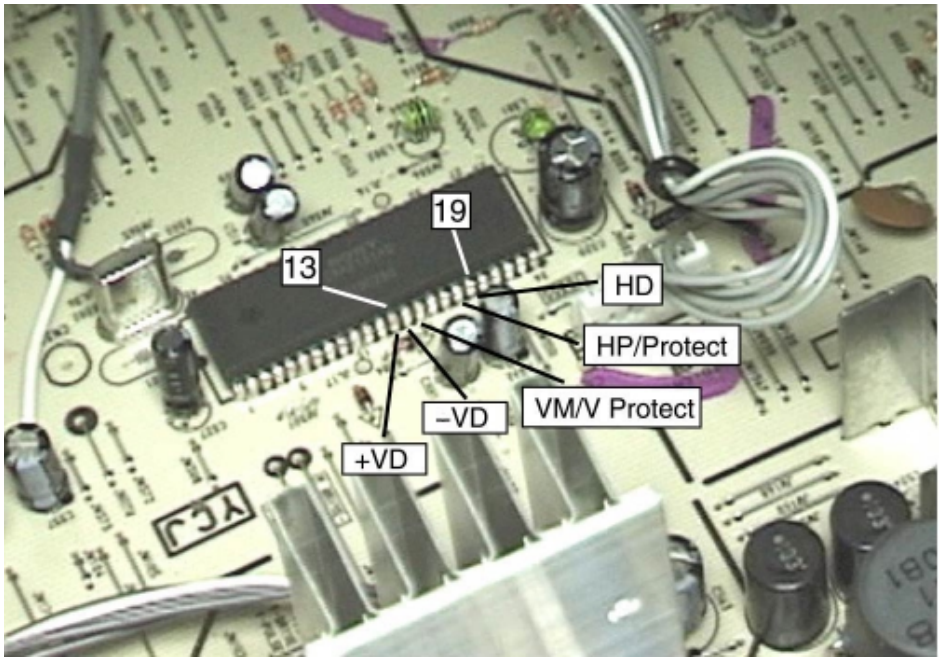
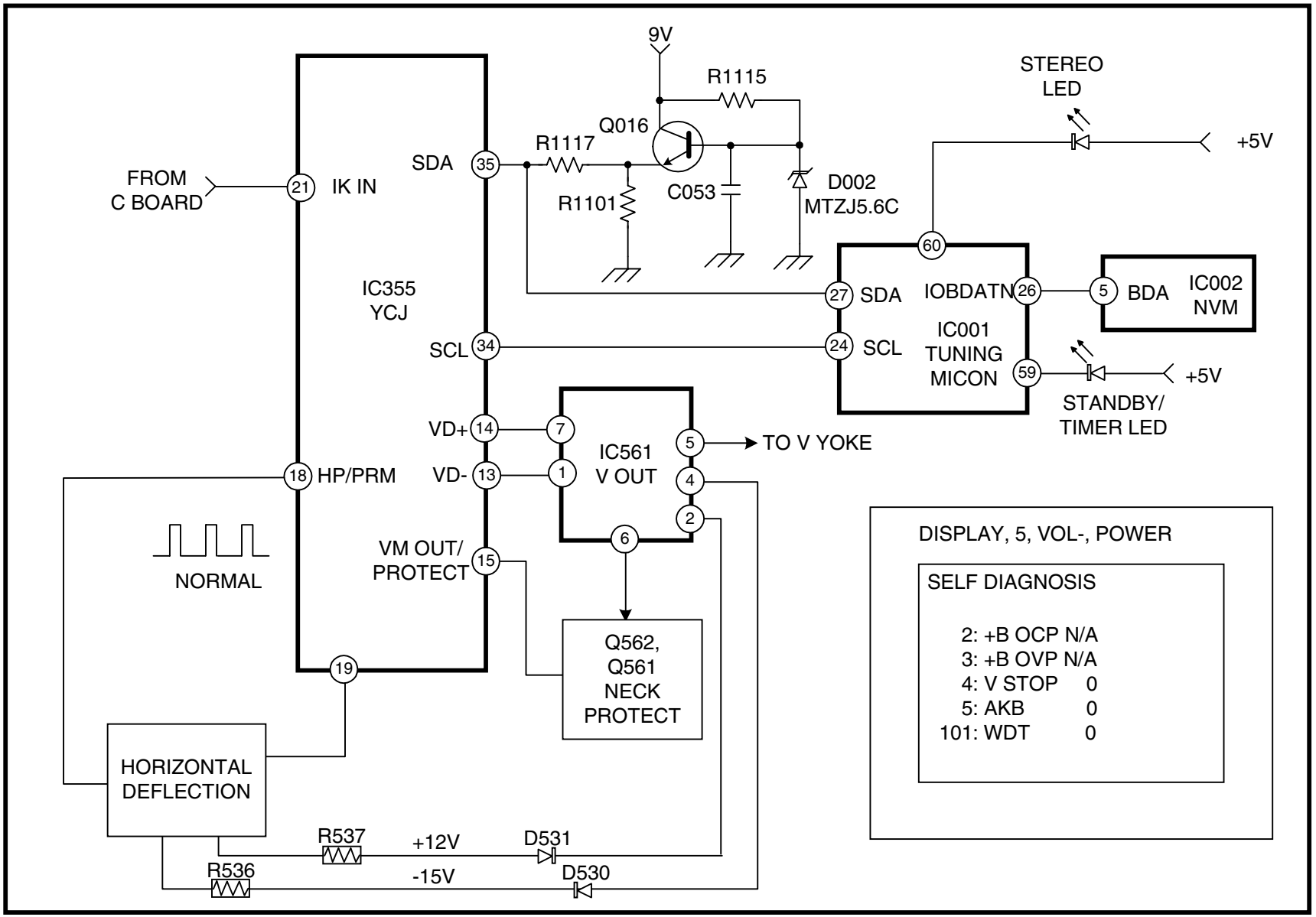
1. Check for +12 and –15 volts at R536 and R537. If one or both of these voltages are missing, check to see if the FBT signal is present on the other side of each resistor. If the signal is not present at these resistors, it indicates a horizontal problem.
2. If the signal is not present at these resistors, check for the HP signal at IC355/18. If this signal is LOW, it indicates that something is wrong with the horizontal section and the horizontal drive at IC355/19 will be disabled. Troubleshoot the horizontal circuit.
3. Horizontal drive should be present when the set is initially turned ON. You can troubleshoot this section by continuously turning the set ON and OFF and tracing the horizontal drive signal to the horizontal output. A shorted horizontal output would not be an issue under this circumstance since that kind of failure would cause power supply shutdown.
4. If +12 and –15 volts are present, check for Vertical Drive at IC355/13 and 14. If these signals are present, troubleshoot the vertical output circuit. These signals should be present during vertical failure. If they are not, replace the YCJ.





I²C Problems

Q016 and related circuitry form a voltage regulator, which is used to supply power to the I²C data line through pull-up resistor R1117. The purpose of this circuit is to reduce the level of the I²C data if the 9-volt line is LOW. If this occurs, the data will not be recognizable to the ICs on the bus. When this data is LOW or missing, the set will turn ON normally with three clicks but there will be no sound, video, LEDs and vertical deflection. Horizontal and High Voltage will be operating normally. Glowing heater filaments are an indication of normal horizontal operation.



SELF-DIAGNOSTICS

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Power Supply Block

Overview

The power supply in the AA2U chassis is located on the G board. It is nearly identical to the power supply in the AA2W chassis. AC from the outlet is applied to a series of line filters and protection devices and is eventually applied to the standby supply, AC rectifier and degauss circuits. The Standby supply is a switching supply whose output is applied to a 5-volt regulator. The output from the regulator exits the G board at CN641/10. It is applied to various components in the set that need to be powered when the set is OFF. These include the Micon, remote sensor and S Link circuitry if applicable.

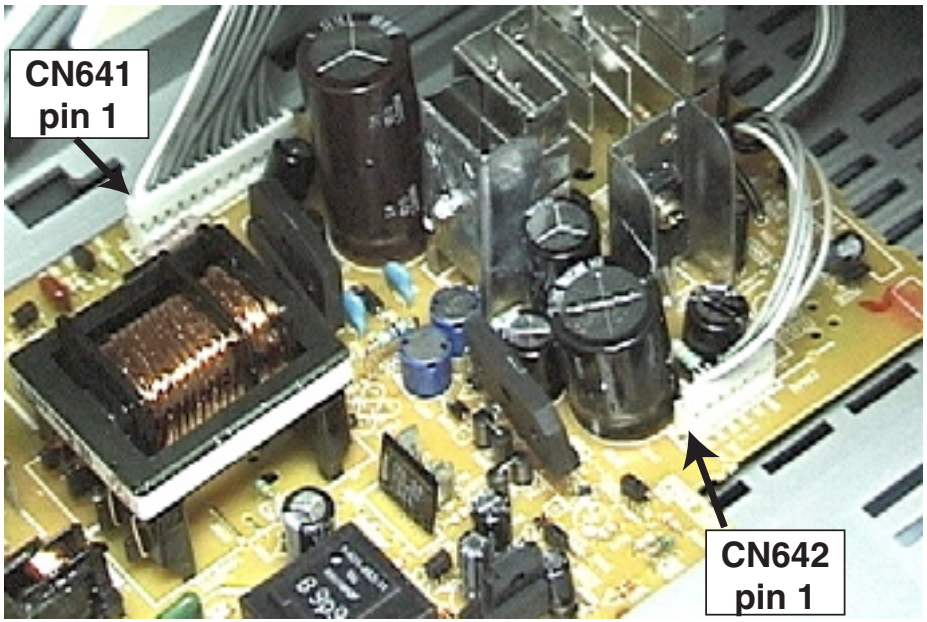
When the set is turned ON using the power button, remote control or S Link, 5 volts is applied to CN641/11. This 5 volts is used to turn RY600 Power Relay ON. When the relay closes, a click is heard. Closing the relay allows the AC voltage to be rectified and applied to the converter circuit. The converter begins operation when this voltage is applied. The power ON line is also applied to the soft start circuit. The soft start circuit holds the B+ voltage low while the power supply capacitors charge by controlling the voltage present across the control winding. The control winding determines the switching frequency of the converter. After soft start operation is complete, the regulation circuit takes over operation of the control winding. The regulation circuit produces an error voltage by monitoring the +135 volt line. This allows the converter's output to be coupled through T605 to the secondary supplies. These secondary supplies power the rest of the set.

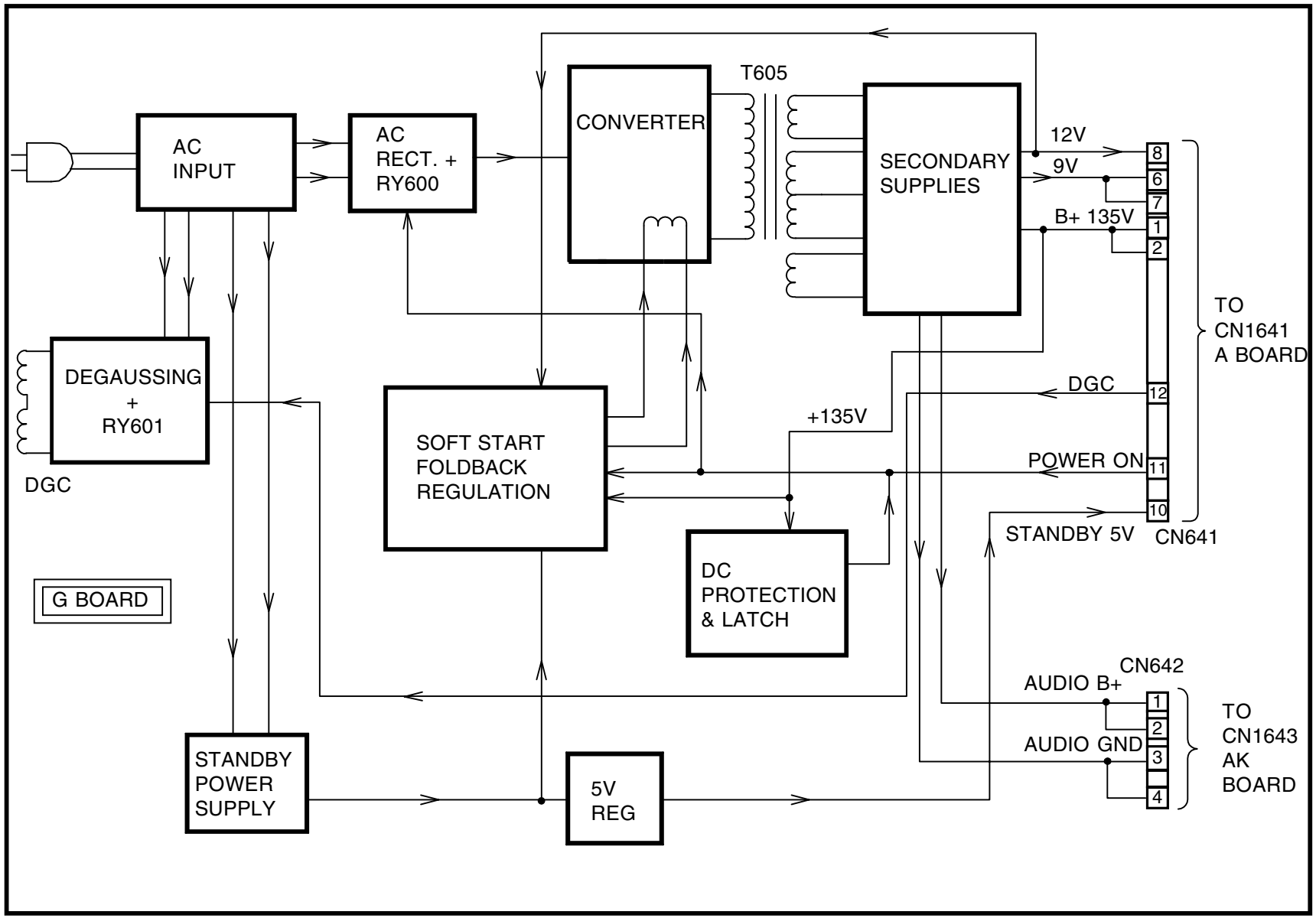
Shortly after the click of the power relay at turn ON, another click is heard. This click is RY601 Degauss Relay closing. This may be accompanied by a hum sound that indicates the operation of the degaussing coils. There is a third click that occurs about 8-10 seconds after the unit is turned ON.

During operation of the set the +135 volt line is monitored for DC protection. This protection circuit is used in conjunction with the latch to switch the Power ON line LOW if a failure should occur. This will turn RY600 Power Relay OFF and turn the power supply OFF. In addition, a foldback circuit can also shut down the power supply. The foldback circuit compares the secondary's +12 volt output to a voltage on the primary side. If there is a problem with either one of these circuits, the set will be forced into soft start mode. This will cause the set to shut down.

Troubleshooting

Use this drawing to quickly check voltages on the G board connectors. These connectors can be accessed by pulling the three boards at the bottom of the chassis towards the rear about 3 or 4 inches.





POWER SUPPLY BLOCK

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Standby Power Supply

Overview

The standby power supply is a switching power supply used to create Standby 5V. The Standby 5V line is used to power the Tuning Micon, EEPROM and any other circuits which require power when the set is OFF.

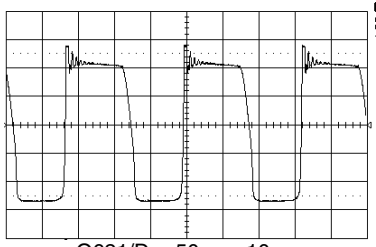
Converter Operation

Operation of the Standby power supply begins when the set is plugged in. The AC line voltage is applied across the standby power supply. The AC low side is ground for this circuit. The AC high side is applied to a half wave rectifier consisting of D621 and D622. Two diodes are used so that there will be protection should one of them fail. This voltage is then applied to T621/1 SRT Input through R639. R639 is a fusible resistor used for current limiting and failure protection. It will open if the standby switching circuit draws excessive current. Please note that the board has T621 SBT silk-screened on it.

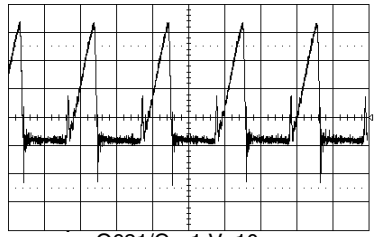
When the voltage is applied to T621/1 SBT Input, current flows through the winding and R631 to Q621/G. Q621 Converter is a FET with added protection. When a positive voltage is applied to the gate, it begins to conduct drain to source. This reduces the voltage at T621/3 to close to zero. Normally this would reduce the voltage at Q621/G, but a voltage is supplied to the gate through R632 and C630 from T621/4. This voltage is induced into the secondary winding of T621/4 when current flows through the winding between T621/1 and T621/3. The voltage is not permanent due to C630. As C630 charges, it reduces the voltage at Q621/G. Once this voltage falls below a certain threshold, Q621 Converter turns OFF.

Once Q621 Converter turns OFF, all polarities are reversed. This reversal of polarity helps speed up turn OFF of Q621. D623, along with C631 and R640, forms a snubber network (voltage clamp). This network clamps excessive voltage overshoot caused by the collapsing magnetic field of T621 SRT and returns the excessive voltage to C629. When the field collapses fully, current begins to flow through T621/1 and 3.

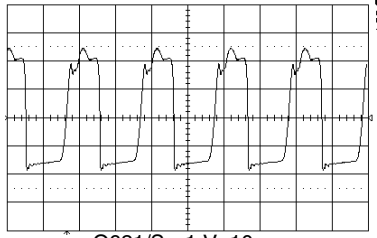
The waveforms below show what will be seen at Q621:



Q621/D - 50 mv, 10 us



Q621/G - 1 V, 10 us

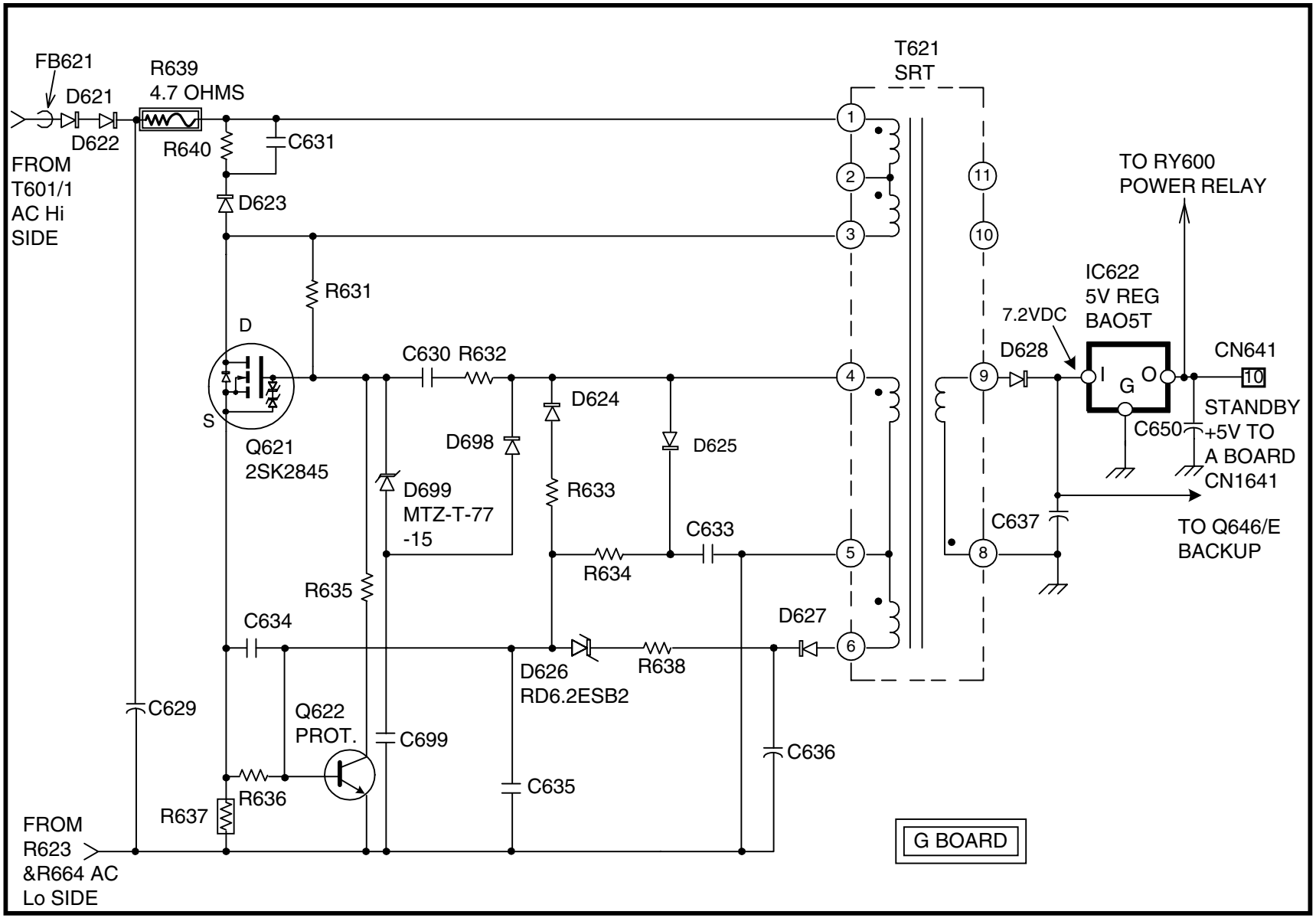


Q621/S - 1 V, 10 us

Regulation

Changing the frequency of the switching regulates the output voltage at the secondary winding comprised of T621/8 and 9. This is done by taking a sample voltage from T621/4 and applying it to rectifiers, D624 and D625. As this voltage rises and falls, the rectified voltage is applied to Q622/B through R634. When Q622 begins to conduct, it lowers the voltage at Q621/G and changes the switching frequency.

The changing frequency will change the amount of voltage coupled to the secondary winding consisting of T621/8 and 9. If the load on the secondary output increases,the frequency of switching will decrease. This brings the frequency of the converter closer to the optimum operating frequency of T621 SRT. Moving closer to this optimum frequency causes more voltage to be provided at T621/9. The opposite occurs when the load on the supply decreases. The frequency of operation is increased and the amount of voltage coupled to T621/9 is decreased. The supply typically operates at 45 kHz when the set is OFF, and at about 30 kHz when the set is operating. The incoming line voltage also effects the frequency of switching operation.



STANDBY SUPPLY

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Over Current Protection (OCP)

Monitoring the voltage across R637 is used for over current protection. This voltage is representative of the amount of current flowing through Q621 Converter since it is in series with the transistor. If this voltage should rise to .6 volts, it will cause Q622 to turn ON. If Q622 were to turn ON, it would shunt Q621/G voltage to ground. This would cause Q621 Converter to stop conducting. This is a non-latching protect circuit.

Over Voltage Protection (OVP)

Over voltage protection is performed by rectifying the voltage at T621/6 with D627. This voltage is filtered by C636 and applied to D626 through R638. If this voltage should rise above 6.2 volts, D626 begins to conduct. When its conduction allows Q622 Protect to turn ON, over voltage protection is employed. Q622 Protect turns ON and grounds Q621/G, which stops the converter from switching.

D699 is also used for OVP. The signal from T621/4 is rectified by D698. This creates a negative voltage across C699. If this negative voltage becomes great enough, D699 conducts and the Q621/G voltage is brought lower. Both of these protect circuits are non-latching.

Secondary Output

The power coupled through T621 SRT places a voltage on T621/9, which when rectified and filtered by D628 and C637 is 7.2 volts. This voltage is constant due to the regulation circuit on the primary side of T621 SRT. This 7.2 volts is applied to Q646/E for backup during the start of regulation by the regular power supply.

It is also applied to IC622 5-Volt Regulator, which regulates its output to 5 volts. This 5 volts is sent to CN641/10 which connects to the A board and powers the Tuning Micon and other circuits. It is also applied to RY600 Power Relay.

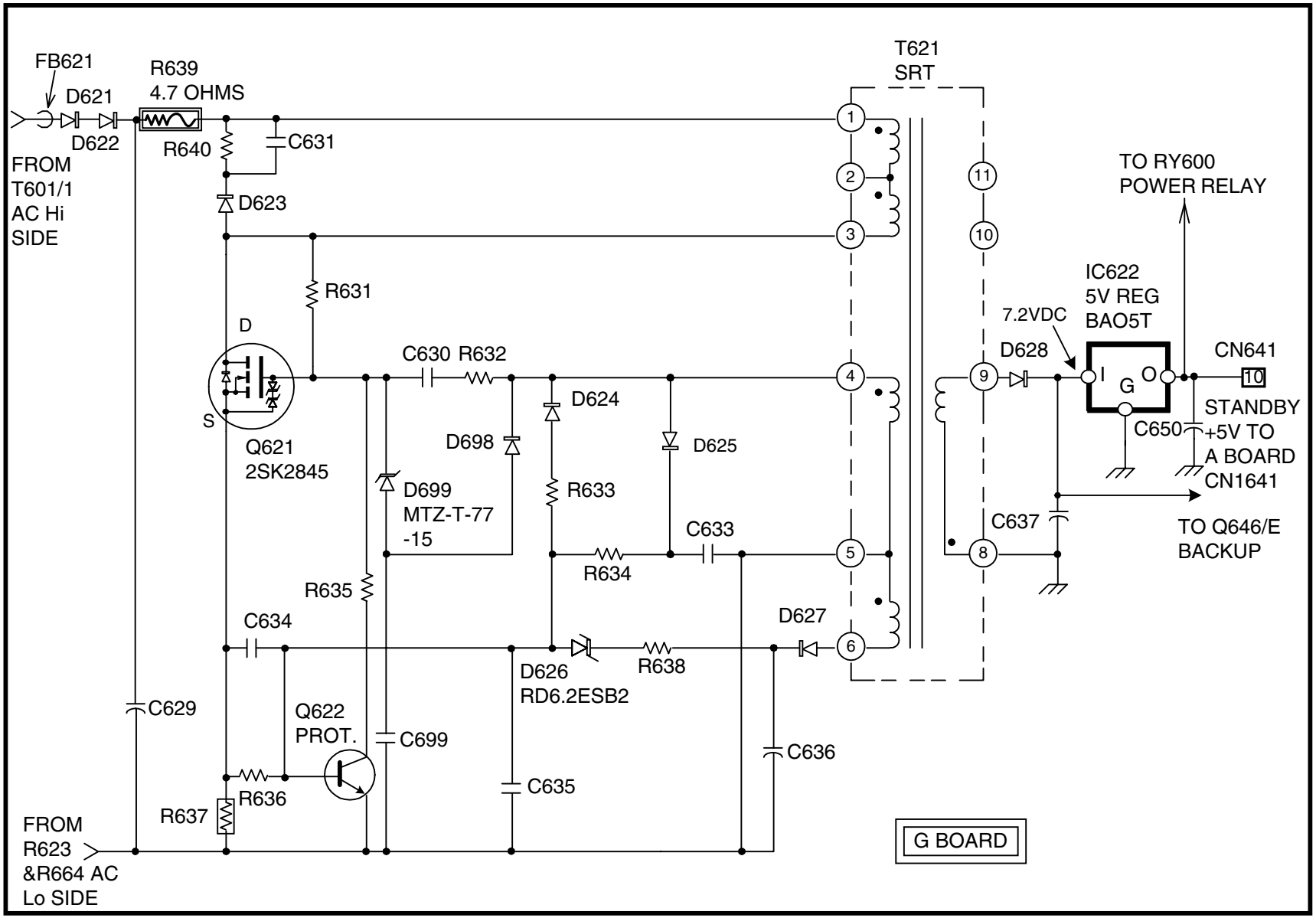
Checking Q621

Testing a MOSFET device is easy. The leads show infinite resistance to every other lead except for drain to source in one direction because of the presence of a protection diode.

To prove the device is functional:

1. Connect the negative lead of the ohmmeter to the SOURCE lead.
2. Touch the ohmmeter positive lead to the gate to pre-charge it.
3. Connect the ohmmeter positive lead to the DRAIN. If the device is good, you will get a resistance reading of about 400-1k ohms.

Some DVMs do not produce enough DC voltage in the ohms mode. The diode check mode can be used with these models. When using the diode mode, a low voltage drop is shown after pre-charging the gate.



STANDBY SUPPLY

3 CTV26 1187 10/12/00

Power On/Degaussing

Overview

This section discusses how the converter B+ voltage is created when the set is turned ON. When the set is turned ON the degaussing circuit is activated.

Power On

When the set is plugged in, the AC voltage is applied through F601, T601 and T602. Additional components C605, VDR601, C604 and VDR602 are across the AC line input. They are in place for protection from AC line spikes and surges. This AC voltage is applied to the standby power supply and will be applied to D602 Bridge Rectifier when RY600 Power Relay is closed. R623 and R664 will limit the current when the relay is initially closed.

When the customer turns the set ON using either the remote or the power switch, a 5-volt signal is output from IC001/62 Tuning Micon O-Relay. This HIGH is sent to the G board via the wiring harness between CN1641 on A board and CN641 on the G board.

This signal is used to turn Q648 ON. When Q648 turns ON, it places a LOW at its collector. This causes RY600 to energize, closing the contact and allowing current to flow to D602 Bridge Rectifier. The LOW from Q648/C is also applied to the Q646 Backup and Q647 Soft Start transistors.

Voltage Doubler

D602 Bridge Rectifier is used with C606, C607, D629 and D630 to form a voltage doubler. Therefore the output of the voltage doubler is approximately 310 VDC. This voltage will be referred to as Converter B+. Converter B+ is applied to the converter circuit through R607. R607 is a fusible resistor. If the converter circuit draws too much current, it will open. When RY600 Power Relay is closed, a click is heard. When the Converter B+ is applied to the converter circuit, it will begin to operate and supply power to the rest of the set.

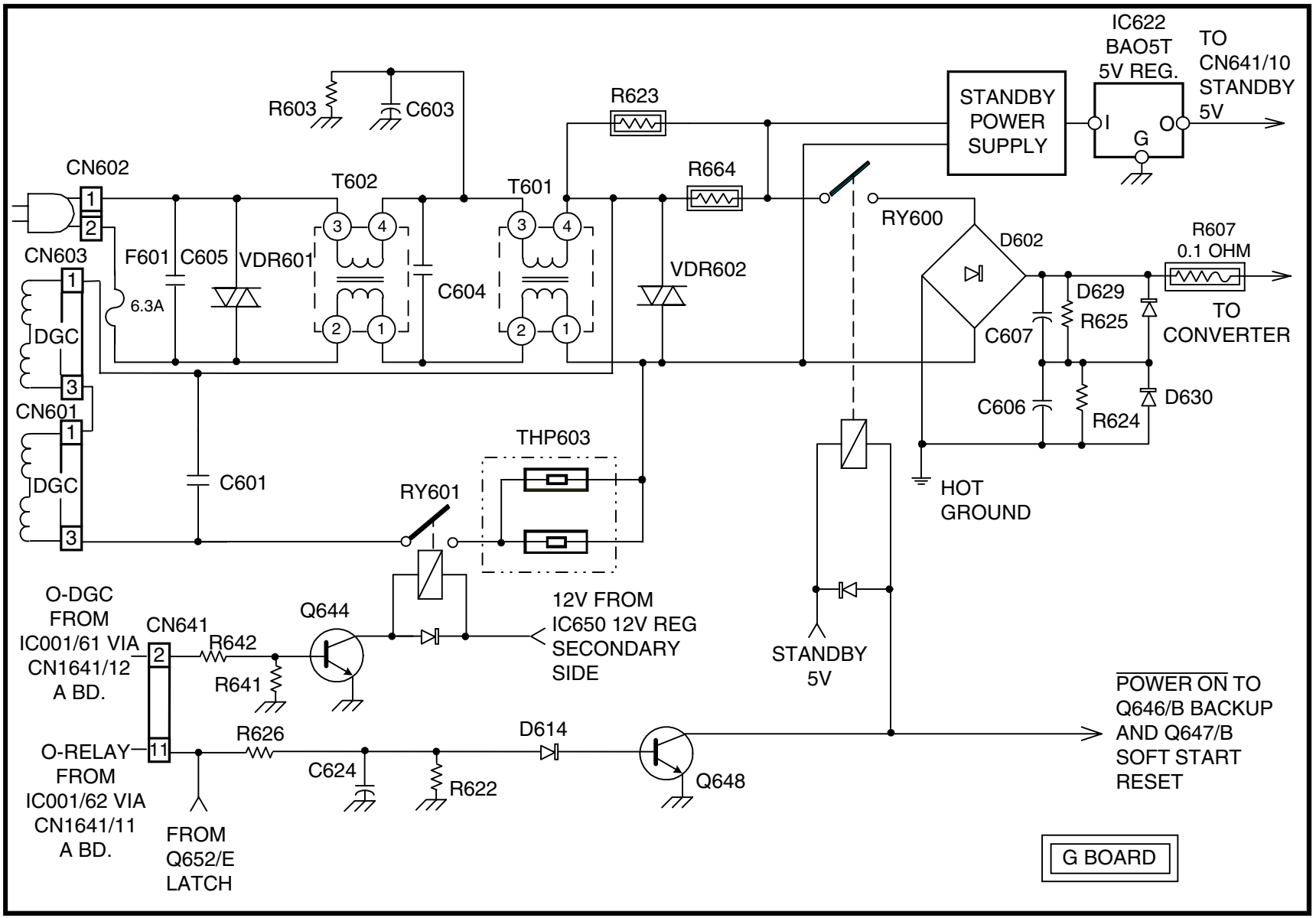
Degaussing

When the set is turned ON, a click is heard from the Power Relay RY600. About one second later another click is heard from RY601 Degauss Relay. After this a loud hum can be heard. This indicates that the degaussing circuit is operating. The degaussing circuit operates because every time the set is turned ON, a HIGH is output from IC001/61 Tuning Micon O-DGC. This HIGH is applied via the cable between CN1641 on the A board and CN641 on the G board. This voltage is used to turn ON Q644. When Q644 is turned ON and 12 volts from the secondary is supplied, RY601 is energized causing current to flow from the AC line through THP603. When current flows, 120VAC is applied to the degaussing coils. When this occurs, a hum can be heard.

THP603 contains two thermistors whose resistance increases as they get warmer. The thermistors should read less than 10 ohms when cold. The current flowing through them when voltage is applied to the degaussing coils is great and causes the thermistors to open after a few seconds. This stops the action of the degaussing coils since no more current is flowing through them. The set will not degauss if the set is turned OFF and ON again quickly. Typically you need to wait at least a few minutes until the thermistors have cooled to degauss again.

If the degaussing circuit is not operating, no hum will be heard when the set is turned ON. It is also likely that purity problems will occur since the tube could become magnetized.

Room vibrations may cause the contacts of RY601 to make contact when they are not supposed to. This would cause the degauss coils to be activated while the set is producing a picture. If this occurs the customer may complain about intermittent rainbow pattern or intermittent loss of purity. If a customer complains about this try replacing RY601.



POWER ON/DEGAUSSING

4aCTV28 11/3/00

Converter

Overview

The function of the converter is to switch the Converter B+ voltage through a transformer's primary winding. This switching will produce a signal that will be coupled to the transformer's secondary windings where the signal is rectified and used to supply various voltages to the set. The frequency of this switching is controlled to maintain a consistent value on the +135 volt line. Changing the frequency of the switching can be used for regulation due to the efficiency characteristics of the transformer. A second transformer with a cross-inductance winding is used to create a "dual tank oscillator". The voltage across the cross-inductance winding or control winding is used to change the value of the inductance in the tank circuit and therefore change the frequency of switching to maintain the 135 volt line.

Initial Start Up

When RY600 Power Relay (not shown) is closed, 300 VDC is developed and applied to R607. Converter B+ is then applied to C613 and C615. C613 ensures that the bottom transistor IC601-1 turns ON initially by keeping Ic601-2 OFF. When IC601-1 turns ON, there is a current path through C615, T605/1 and 2, and T603/1 and 2 through IC601-1/ C-E to ground. The voltage applied to IC601-1/B by T603/4 sustains this current path. This voltage at T603/4 is developed by the expanding magnetic field being produced by the current flowing through T603/1 and 2. When the magnetic field in T603 PRT stops expanding, IC601-1 turns OFF. When this occurs, a voltage is induced by the collapsing magnetic field at T603/3 that turns IC601-2 ON. This provides a discharge path for C615. When C609 is fully charged, IC601-2 will turn OFF. This cycle will continue to repeat itself. As the voltage across T603/7 and 8 Control Winding changes, the inductance of the other windings will change. This will determine the frequency of switching.

Soft Start

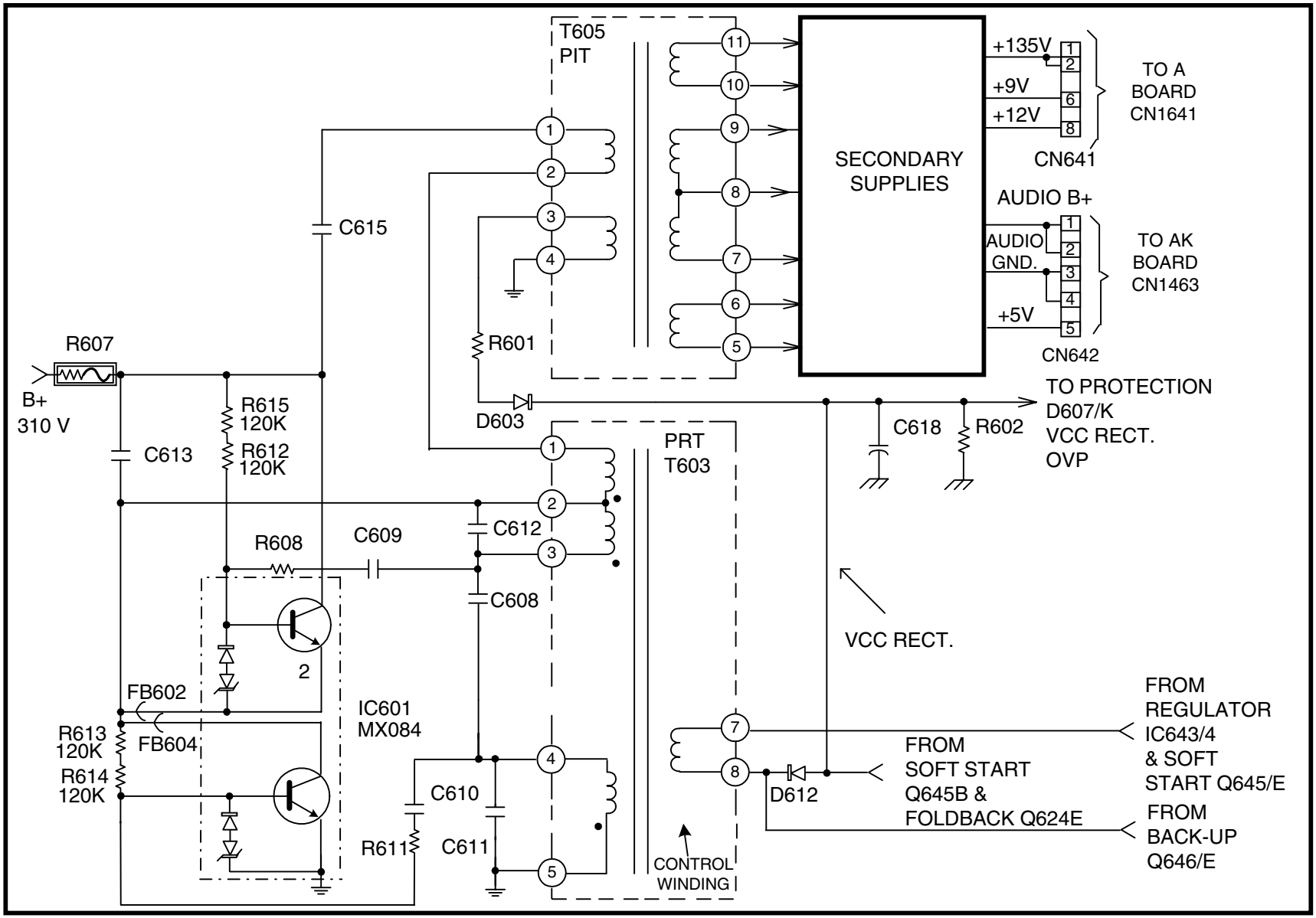
The voltage across T603/7 and 8 Control Winding determines the frequency of operation. The control winding is a cross inductance winding. At initial startup the converter has to operate above the optimum power transfer frequency of T605 PIT. A soft start circuit is used to ensure that this occurs. The soft start circuit will ensure that a voltage of approximately 7 volts will be applied across T603/7 and 8 Control Winding during initial turn ON. After the converter begins to run, the voltage from the Vcc Rect. line is applied to T603/8 through D612. The voltage applied to T603/7 will then come from the regulator circuit instead of soft start.

Regulation

The frequency of the power supply is dependent on the load that it sees. When the picture brightness increases, the load increases. This lowers the voltage across T603/7 and 8. When this occurs, the frequency of the oscillator decreases, allowing T605 to supply more current to the secondary windings. This keeps the 135V line from lowering in voltage.

The following table shows what occurs with different loads on the supply. Note that the oscillator frequency changed but the 135V line remained within a few tenths of a volt of its value. You should also be aware that the frequency of operation is also dependent on the input AC line voltage.

Location	White Raster	No Input
V across pins 7 & 8/T603	2.41 VDC	2.62 VDC
Freq. at IC601/E2	74 kHz	78 kHz
V at CN641/1	135.5 VDC	135.7 VDC



CONVERTER

2aCTV28 11/10/00

Troubleshooting

One of the most common failures in switching power supplies are the converter transistors, or in the case of this power supply, IC601. IC601 actually contains two identical transistors. They are assembled in this package so that their gain and other characteristics are closely matched. Generally when these transistors fail, they fail by shorting C-E in one or both of the transistors. This causes the fusible resistor to open due to excessive current draw. The fusible resistor in this case is R607. The symptom in this set is that you hear only one relay click on initial power up instead of three. Usually you would hear two, the power relay, followed by the degaussing relay. This would be followed by another click about ten seconds later that indicates the degaussing relay is turned OFF. You can check the voltages around IC601 to troubleshoot this problem. There would be no voltages present since R607 would be open due to the shorted transistor.

You should always check the horizontal output for shorts when the converter transistor has failed. It is also a good idea to unload the power supply and bring the line voltage up slow using a variac.

When performing this procedure set your variac to zero and jumper the relay contacts. **Warning: By jumping the relay contacts you have defeated the protection circuitry of the power supply.** Plug the unit into the variac and bring the AC voltage to 30 VAC. You should have stable oscillation at this point. Check to see how much current is being drawn from the AC line. The current drawn should be minimal since the supply is unloaded. Check the voltages at the points in the table below. The oscillator voltage and frequency are measured at T603/2. The secondary voltages can be easily checked at CN641 and CN642. Increase the line voltage by ten volts and check each item in the table again. Repeat this procedure at 50 and 60 VAC. **Warning: It is not recommended that the power supply be operated unloaded above 60VAC.**

Another problem that may occur is that the switching never starts. To troubleshoot this type of problem remove one lead from C615. When you power the set ON, you should have a DC voltage of half the Converter B+ at T603/2. This is where the switching waveform would normally be present. If the voltage is lower at this point, suspect an open related to IC601-2 or a leaky component related to IC601-1. If the voltage is high at this point, suspect an open related to IC601-1 or a leaky component related to IC601-2.

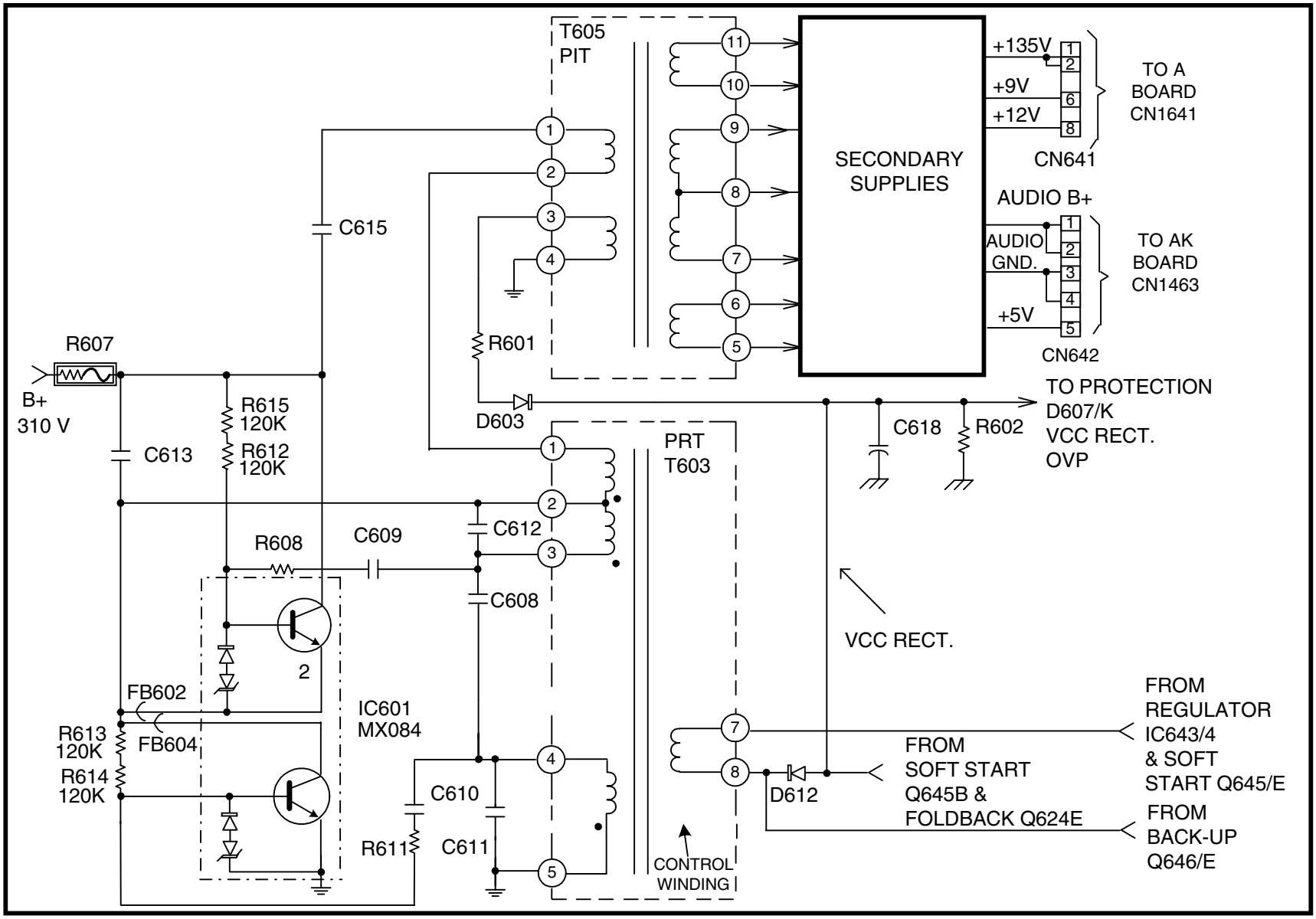
AA2U Chassis Power Supply Output Voltages Fully unloaded (CN641 and CN642 unplugged)

	Primary (Hot Ground)		Secondary (Cold Ground)			
Variable AC Input	Oscillator Voltage	Oscillator Frequency	135	12	9	Audio B+
30Vac	80 Vp-p	145 kHz	29.7V	2.7V	.49V	18.9V
40Vac	120 Vp-p	145 kHz	39.5V	3.7V	3.4V	21.3V
50Vac	150 Vp-p	147 kHz	46.1	4.3V	3.9V	21.3V
60Vac	150 Vp-p	147 kHz*	56.2V	5.3V	4.6V	22.4V

*Oscillator begins to be unstable at this point.

Resistance Measurements

Another method that can be used after a power supply repair is to take a resistance measurement on the connectors that connect to CN641 and CN642. The points measured should be the 135, 12, 9 and Audio B+ pins. These points should measure similar to a capacitor. The resistance measurement is low and slowly rises. Any steady low resistance measurement is an indication that there is a short or excessive load in one of the circuits that is fed by that power supply line. This problem will need to be fixed before the power supply is reconnected and powered up.



CONVERTER

2aCTV28 11/10/00

Soft Start/Regulation/Foldback

Overview

The three circuits discussed here all have an affect on the voltages across T603/7 and 8. This winding of the PRT is a cross inductance winding or control winding that controls the frequency at which the converter operates.

Soft Start

At power ON, C602, which is discharged, has a 0V potential at its + terminal. This biases Q645 ON, via R647. With this transistor ON, it allows the standby unregulated from Q646/E to be applied across T603/7 and 8. This voltage is passed through Q646 Backup since the same line that turns RY600 Power Relay ON turns it ON. The greater the voltage across this winding, the higher the converter frequency and lower the efficiency of T605 PIT, which is discussed in the Converter section. Therefore, the start up secondary voltages will be reduced considerably. As C602 charges, the voltage difference between T603/7 and 8 diminishes. As this voltage lowers, the secondary voltages will rise. When the Vcc Rectifier voltage is larger than the Standby unregulated voltage, D612 will begin to conduct and the Vcc Rectifier voltage will control T603/8. Also at this time C602 will be fully charged and IC643 Control IC will take control over T603/7. The difference in voltage between T603/7 and 8 will regulate the converter's operating frequency.

Soft Start Reset

It is important that the soft start capacitor C602 be fully discharged when the set is turned OFF. Turning Q648 OFF when the unit is turned OFF does this. This removes the ground path from the relay, opening it up. It also allows current from the Standby +5V to flow through the relay coil, through R621, to Q647/B. This turns the Q647 ON, and discharges C602 through R627.

Q646 Backup will also be turned OFF when the Power On line becomes HIGH.

Regulation

The power supply is regulated by the control winding of PRT T603/7 and 8 in the following manner:

An increase in voltage across the control winding will reduce the inductance of the windings in T603, thereby increasing the converter frequency. When the converter frequency increases, it moves further away from the optimum operating frequency of T605 PIT and reduces the voltage at the secondary outputs. The opposite occurs when the voltage across pins 7 and 8 decreases.

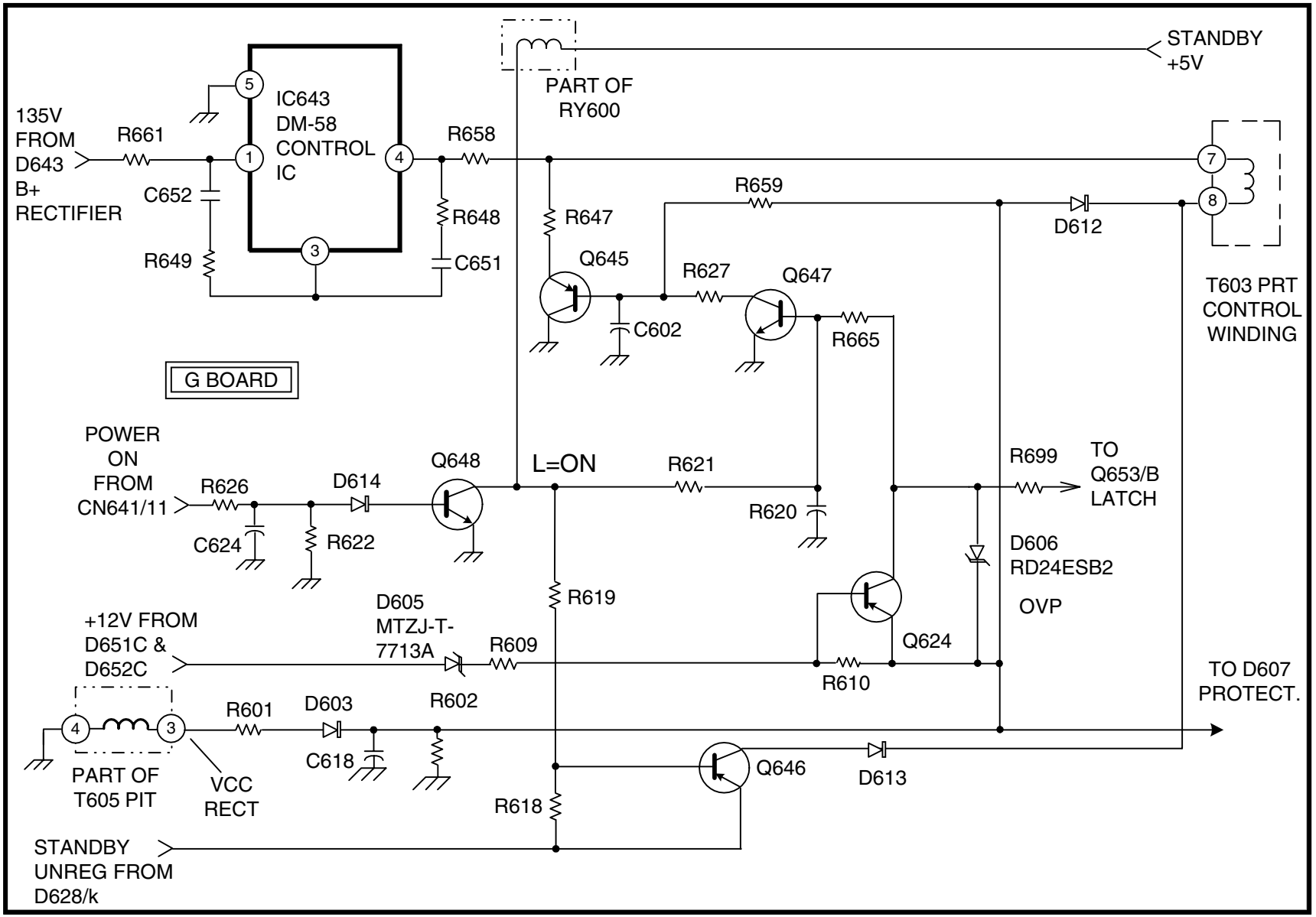
A correction voltage is produced by IC643/4, which varies inversely proportional to the 135V line. Pin 7 of the transformer control winding is connected to the correction voltage. The other leg of the control winding (pin 8) is connected to the output from D603 Vcc Rectifier. The difference in the voltage across this winding determines the frequency of the converter which regulates the +135 Volt line as described in the previous sections.

Foldback

The foldback circuit is a type of protection circuit that uses a winding on T605 PIT to monitor the current drawn by its secondary. This voltage is rectified and called Vcc Rect. Q624 is set up with the Vcc Rectifier voltage input to the emitter. Its base is connected to the Rectified +12 volt line from the secondary side of the supply, through D605 and R609. D605 is a zener diode whose breakover voltage is 13 volts. This circuit will protect against two failures.

The first is a rise in the Vcc Rect. This voltage is developed by the foldback winding of T605. This winding is used as a current mirror. This means that the more current drawn on the secondary of T605 PIT, the higher the voltage at T605/3. When too much current is drawn from the secondary, Q624 would turn ON because of the increase in voltage across R610. If this occurs, the latch and soft start circuits will be activated. Soft start is activated to lower the output supply voltage by increasing the switching frequency. The latch's purpose is to shut the supply down.

Secondly, if there were a loss of the +12 volt line then D605 would breakover. This would cause sufficient current flow through R610 and Q624 would turn ON. If this occurs, the latch and soft start circuits will be activated.



SOFT START/FOLDBACK/REGULATION

5aCTV28 11/9/00

Secondary Voltages

+135 Volts

The signal from the winding of T605/10 and 11 is applied across D643 Bridge Rectifier. C643 and L642 filter the rectified voltage. D648 is a 150-volt zener diode that will limit the voltage to 150 volts in the event of a failure that causes the B+ to rise. This voltage is then sent through R652 and output from the G board at CN641/1 and 2. The voltage is used on the G board by the protection and regulation circuits and is also used to produce the +33 volt line on the A board.

+12 Volts

D651 and D652 rectify the signal from T605/7 and 8. This voltage is filtered by C658 and input to IC650 12-Volt Regulator. This IC outputs a regulated 12 volts, which is filtered by C661 and output from the G board at CN641/8.

+9 Volts

The signal from T605/7 and 8 is applied to D642 through two similar parallel networks consisting of L650 and R670, and L651 and R670. This rectified voltage is then applied to the input of IC641 9-Volt Regulator. This IC outputs 9.6 volts to L652 and also to CN641/6 and 7. The voltage is 9.6 instead of 9 because D647 is connected between the ground pin of IC641 9-Volt Regulator and ground.

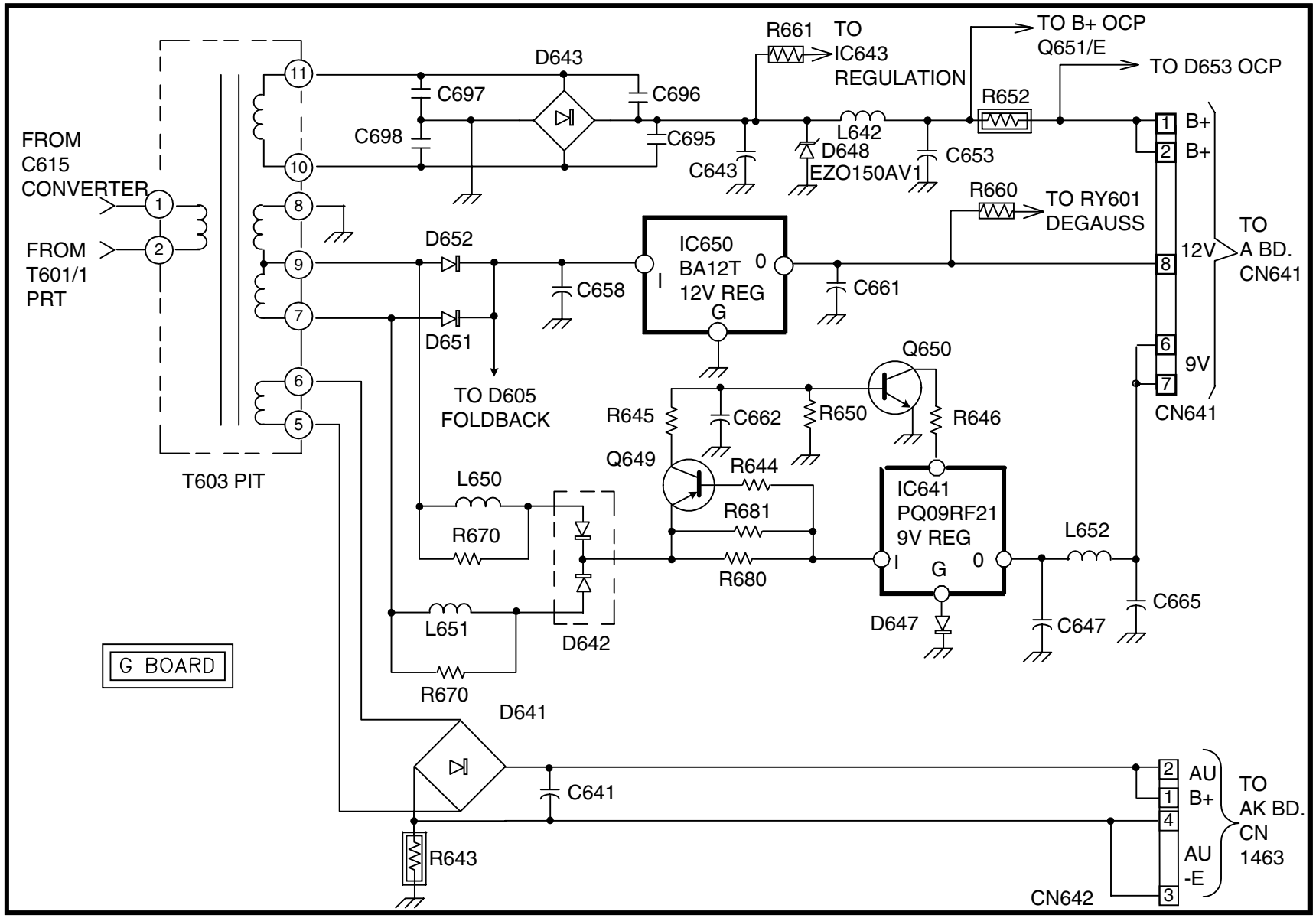
+9 Volt Protection

The +9 volt line also is monitored for OCP. Using the voltage drop across R680, R681 and R644 to control the conduction of Q649 does this. When the amount of current drawn on the 9 volt line is sufficient to cause Q649 to conduct, Q650 will be turned ON. This places a LOW on the inhibit line of IC641 9 Volt Regulator. When there is a LOW present at this pin, the output of IC641 is disabled.

Audio B+

The signal from T605/5 and 6 is applied to D641 Bridge Rectifier. The negative side of D641 is connected through R643 to ground. Therefore the Audio B+ floats slightly above ground level. The voltage output from D641 is filtered by C641 and then sent to CN642/1 and 2 unregulated. The audio B+ is used only by the Audio Output Amplifier IC1461 located on the AK board. One step in troubleshooting a set that is shut down is to disconnect CN642. If the set operates after this, then replace IC1461 Audio Output. Be sure to discharge the voltage at CN642/1 and 2 before reattaching the connector to CN642.

Shorted Supply	Distribution
+135	A Board - T503 Flyback, H Drive Q501, H Out Q502, Pin Amp Q512, WA board VM Drive Q946
+12	A Board - Q301 HP Buffer, IC353 SHP, All WA board except VM Drive, G Board RY601 DGC Relay
+9	A board - TU102 Tuner, IC351 VM Mute, IC352 YUV Switch, IC354 YUV Switch, IC355 Y/C Jungle, IC1001 D/A Converter, AK Board - IC1401 Audio Processor, IC1403 SRS, Q1102 Tuner 5 Volt Regulator, C Board - Q1790 IK Buffer, UX Board - IC2006 5 Volt Regulator, IC3302 5 Volt Regulator, IC3304 Chroma Decoder, IC3308 YUV Switch
UX5 from IC2006	UX IC2005 3.3 Volt Regulator which powers IC2004 3D Comb Filter
UX5 from IC3302	IC3310 3.3 Volt Regulator which powers IC3303 PIP Processor
Audio B+ (33 volts)	AK Board - IC1461 Audio Output



SECONDARY SUPPLIES

6aCTV28 11/3/00

Flyback Secondary Voltages Distribution

The following voltages are scan derived. This means that some windings of the flyback transformer have their signals rectified to create additional power supply lines:

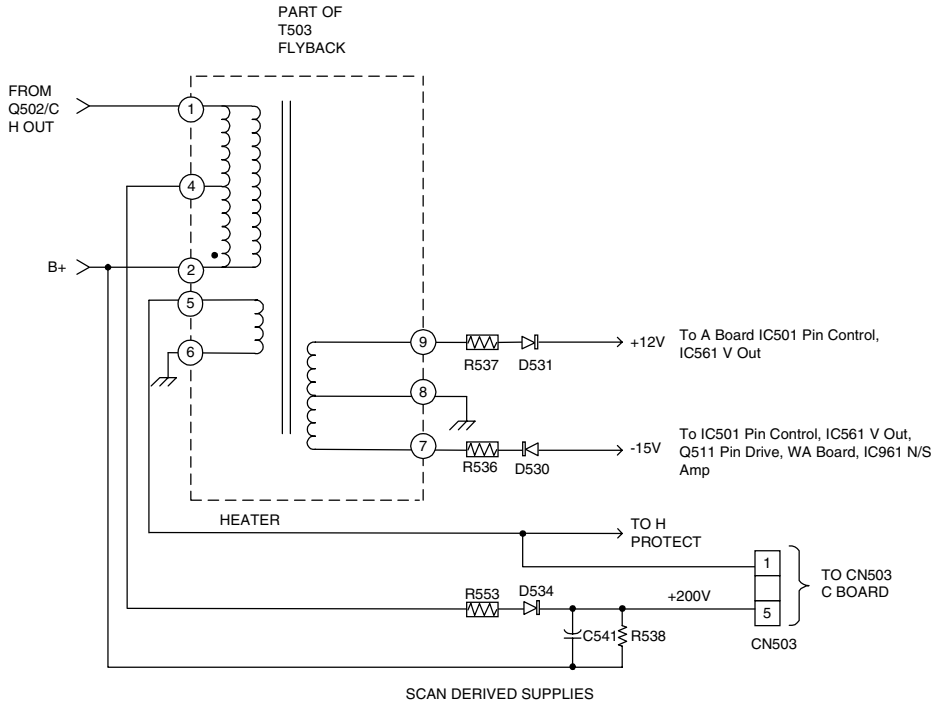
- 200 Volts C Board IC1701 CRT Amp
- +12 Volts A Board IC501 Pin Control, IC561 V Out
- -15 Volts IC501 Pin Control, IC561 V Out, Q511 Pin Drive, WA Board IC961 N/S Amp

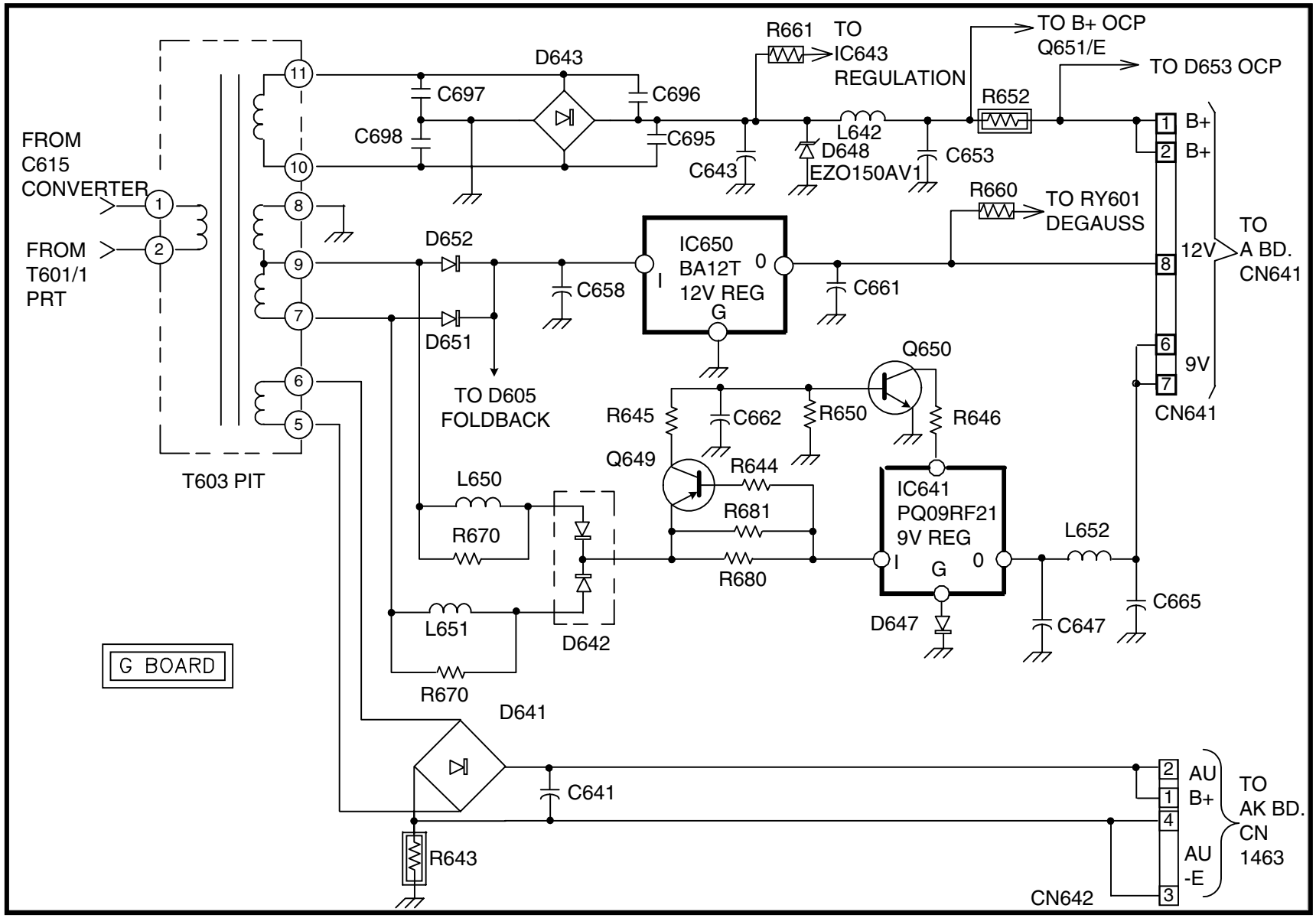
The scan-derived supplies are developed when the output from Q502 H Out is input to T503 Flyback Transformer. This signal is used to create the boosted B+ (+200) on the primary side and the +12 and –15 volts on the secondary side. The signal from T503/4 is sent through R553 and rectified by D534. This voltage is output from CN503/5 on the A board to CN1764 on the C board. This voltage is used to supply IC1761 CRT Amp on the C board. CN1764 can be disconnected to check if problem is with IC1761 CRT Amp. If R553 changes value, the 200-volt line would drop. This would cause the tube to be on continuously. Rescan lines would be seen and the picture would be brighter than normal.

The +12 volt line is derived from the signal at T503/9. It is sent through R537 and rectified by D531. In the event that a short occurs on this line, R537 may open. Since the vertical output is supplied by this line, R537 should always be checked if a vertical output failure is suspected.

The -15 volt line is derived from the signal at T503/7. It is sent through R536 and rectified by D530. In the event that a short occurs on this line, R536 may open. Since the vertical output is supplied by this line, R536 should always be checked if a vertical output failure is suspected.

In addition to the scan derived supply voltages, T503 Flyback Transformer also develops heater voltage from T503/5. T503 also develops High voltage, focus voltage and ABL.





SECONDARY SUPPLIES

6aCTV28 11/3/00

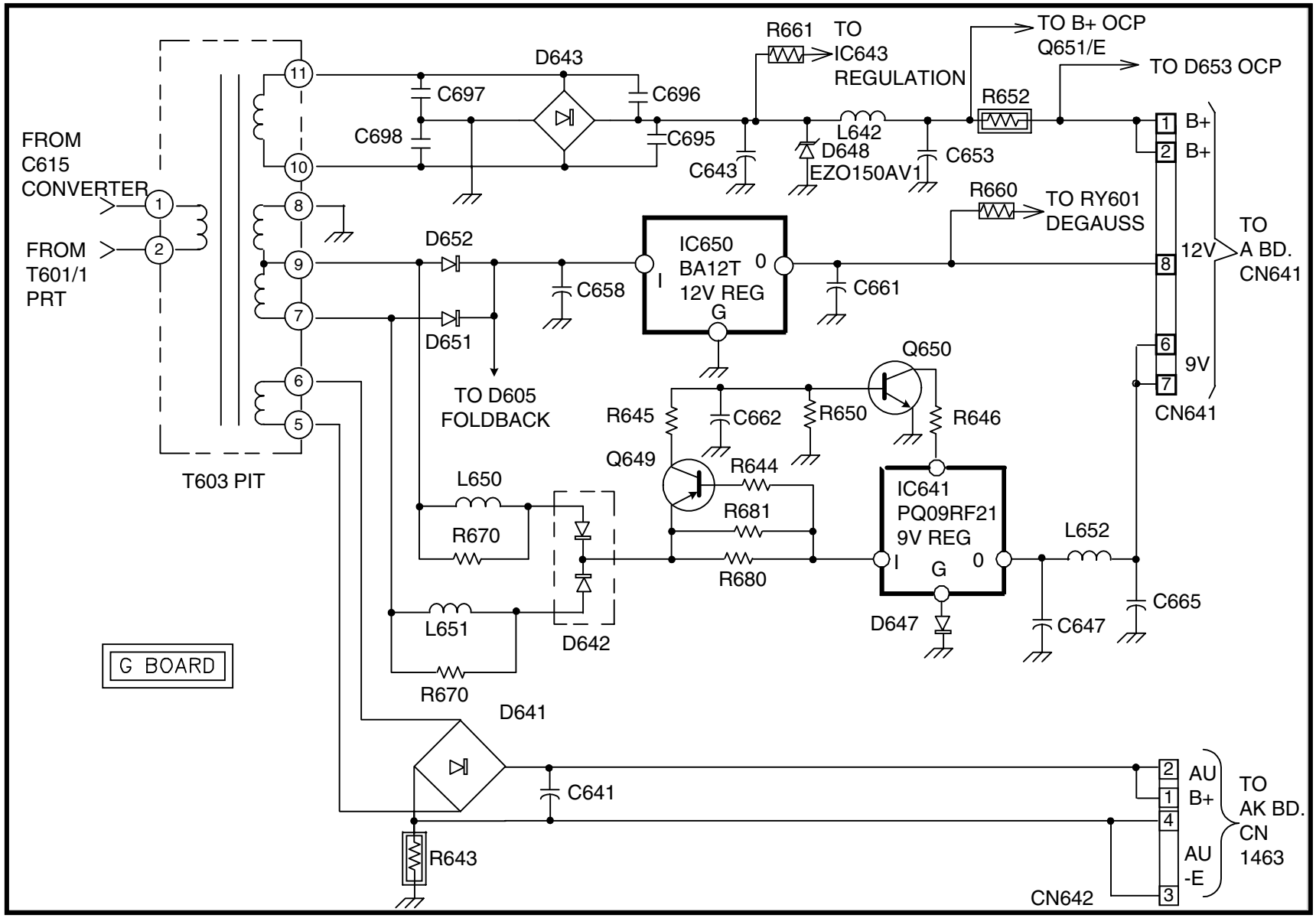
The table below describes various symptoms that can occur if there is a short on one of the power supply lines. These types of problems occur when major components being supplied fail by shorting. An example would be if the horizontal output were to fail, the set might shut down as if the B+ line were shorted.

The Stereo LED can only be used as an indicator if the set is in Tuner Mode. If a failure occurs when the unit is not in the Tuner mode, the Stereo LED cannot be used as a failure indicator.

Voltage	Relay Clicks	Video	Audio	Stereo LED **	Timer LED	HV	Power Switch OFF	Suspect
+135 *	2 clicks very close together Power Relay Only	None	None	ON	Blinks 3x then is OFF	None	No relay click but Stereo LED is OFF	Q502 H Out, T503 Flyback, Q512 Pin Out
+12	1 click. Power relay only.	IK lines visible. OSD expanded almost off screen	OK	Channel dependent	Normal	OK	Unit shuts off normally.	WA board problem or Q301 or IC353 on A Board
+9	Normal	None	None	ON	Blinks 3x then is OFF	None	Power Relay turns OFF and Stereo LED OFF.	Regulators on A board and UX Board. IC355 YCJ
Audio B+	Normal	Normal	None	Channel dependent	Normal	Normal	Normal	PS1461 AK Board
+200	2 clicks very close together Power Relay Only	None	None	ON until power is turned OFF	Blinks 3x then is OFF	None	No relay click but Stereo LED turns OFF	IC1761 CRT Amp. Disconnect CN1764 to verify.
+12	Normal.	None	Norm al	Channel dependent	Blinking in sequences of 4	Normal	Set turns OFF	IC561 Vertical Output. Check R537.
-15	Normal	None	Norm al	Channel dependent	Blinking in sequences of 4	Normal	Set turns OFF	IC561 Vertical Output. Check R536
Converter not switching	1 click. Power Relay only.	None	None	On	Blinking in sequences of 5	None	1 click. Power Relay only.	IC601 and/or R607

*May cause the IC601 Converter to fail.

** Only in Tuner Mode.



SECONDARY SUPPLIES

6aCTV28 11/3/00

Power Supply Protection

Overview

There are three different circuits that can activate the protection latch. One is the OCP (Over Current Protection) for the +135 volt line. The other two are related to the voltage from T605/3 Foldback Winding. When one of these circuits activates the latch, RY600 is turned OFF. This disconnects the AC from the circuit that develops Converter B+. This can be observed during troubleshooting when two clicks are heard in quick succession.

Latch

Placing a HIGH on Q653/B activates the latch. This turns ON Q653, which turns ON Q652. Once Q652 turns ON its conduction keeps Q653 ON until power is disconnected. This places a LOW at Q648/B, turning it OFF. This causes RY600 Power Relay to open and the set turns OFF.

+135 Over Current Protection

Over current is detected by monitoring the voltage across R652. When this voltage, which rises as more current is drawn, gets to a level that causes Q651 to turn ON, the latch will be activated.

Vcc Rectified Low Voltage Protect (LVP)

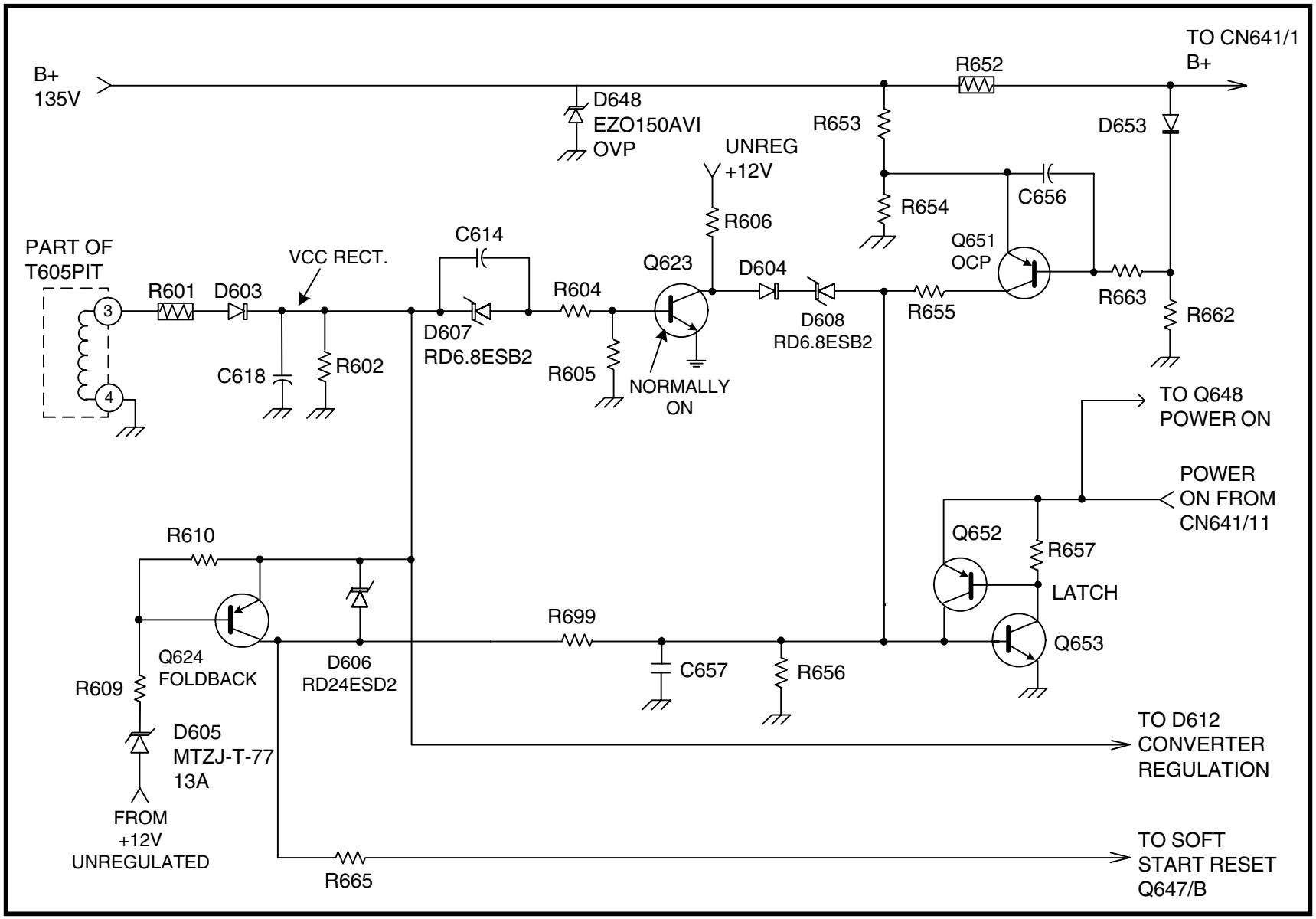
The signal from T605/3 is sent through R601 and rectified by D603. This voltage is filtered by C618. It is important that this voltage be at a certain level since it is used to control regulation. Therefore a circuit is constructed where Q623 is normally ON. This transistor is ON because D607 should always have sufficient bias to turn ON. This will place Q623/C at close to ground level. This keeps D604 and D608 from conducting and activating the latch circuit. If this voltage were to fall below a certain level, D607 would turn OFF, causing Q623 to turn OFF. When Q623 is OFF, the +12 volt line would cause D604 and D608 to turn ON, which would activate the latch.

Foldback

The foldback circuit is a type of protection circuit that uses a winding on T605 PIT to monitor the current drawn by its secondary. This voltage is rectified and called Vcc Rect. Q624 is setup with the Vcc Rectifier voltage input to the emitter. Its base is connected to the Rectified +12 volt line from the secondary side of the supply, through D605 and R609. D605 is a zener diode whose breakover voltage is 13 volts. This circuit will protect against two failures:

The first is a rise in the Vcc Rect. This voltage is developed by the foldback winding of T605. This winding is used as a current mirror. This means that the more current drawn on the secondary of T605 PIT, the higher the voltage at T605/3. When too much current is drawn from the secondary, Q624 would turn ON because of the increase in voltage across R610. If this occurs the latch and soft start circuits will be activated. Soft start is activated to lower the output supply voltage by increasing the switching frequency. The latch's purpose is to shut the supply down.

Secondly, if there were a loss of the +12 volt line then D605 would breakover. This would cause sufficient current flow through R610 and Q624 would turn ON. If this occurs, the latch and soft start circuits will be activated.



POWER SUPPLY PROTECTION

1aCTV28 11/3/00

APPENDIX

Vertical Deflection

The vertical deflection stage consists of the Vertical oscillator, Vertical amplifier, Flyback generator and the Deflection yoke.

The purpose of this stage is to manufacture a magnetic field. The magnetic field will bring the electron beam gradually from top to bottom (vertically) and then quickly back to the top (beam retrace) of the screen to start over again.

Vertical Oscillator

When the TV is turned ON, Set +9Vdc appears at Y/C Jungle IC301/33 and 44. The internal horizontal oscillator begins and is counted down (divided) to 60 Hz to become the vertical drive signal.

The drive signal is formed into a positive and negative ramp and its amplitude and linearity are determined by the serial data from IC001 Tuning Micon. If the data or clock signal at IC355/34 and 35 were missing, there would be NO vertical drive at IC301/13 and 14.

Vertical Amplifier

IC561 Vertical Output is a single package vertical amplifier that outputs a waveform with sufficient amplitude and current to drive the deflection yoke. It is powered by +12 and –15 volts from the flyback transformer secondary.

Flyback / Boost Generator

The vertical boost signal is used to generate extra current in the deflection yoke during the retrace period. This extra current is used to quickly return the electron beam to the top of the picture.

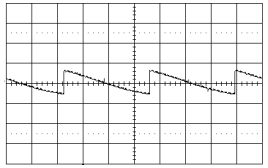
The flyback generator stage within IC561 uses the vertical signal to make a 30Vp-p pulse needed during retrace time. The retrace portion of the vertical drive signal input IC561/1 and 7 is extracted and amplified, and appears at pin 3 as a 30Vp-p pulse. It passes through C565 to provide sufficient current to power IC561/6 during retrace time. Diode D561 blocks this pulse from the +12 volt source.

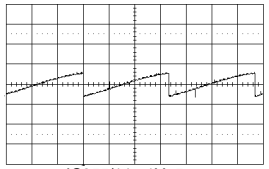
The vertical flyback pulse from IC561/3 is sent to the WA board to be used by the Quadra Pole Focus circuit. It is also goes to C564. C654 blocks any DC and allows the flyback pulses to be applied to Q652/B.

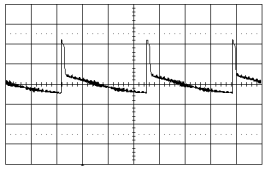
These pulses keep Q652 ON and prevents C563 from charging. Therefore Q561 is always OFF while the set is operating normally. If the vertical flyback pulses were missing, the voltage from the 12-volt line through R570 would forward bias Q561 B-E. This would apply a low to IC355/15 VM Out/V Protect. If IC355/15 were to receive a LOW, the IC would blank the video.

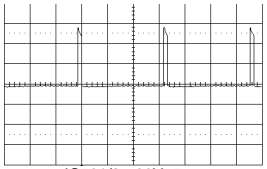
Deflection yoke

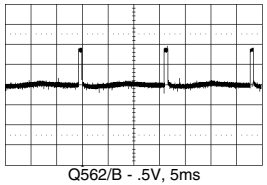
The deflection yoke translates the electrical current flowing through its coils into a magnetic field that positions the election beam vertically. Current flowing through the deflection yoke coil is returned to ground through R578, R563 and R559 and TH501, which are in series. The thermistor is used for temperature compensation. As the vertical yoke draws more current, the resistance of TH501 lowers, allowing more current to flow to the yokes. The voltage developed across these resistors is fed back to the inverting input of IC561/1 through R566 to improve linearity.

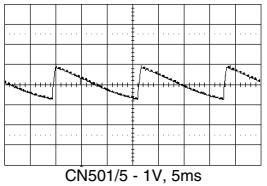

IC355/13 - 1V, 5ms

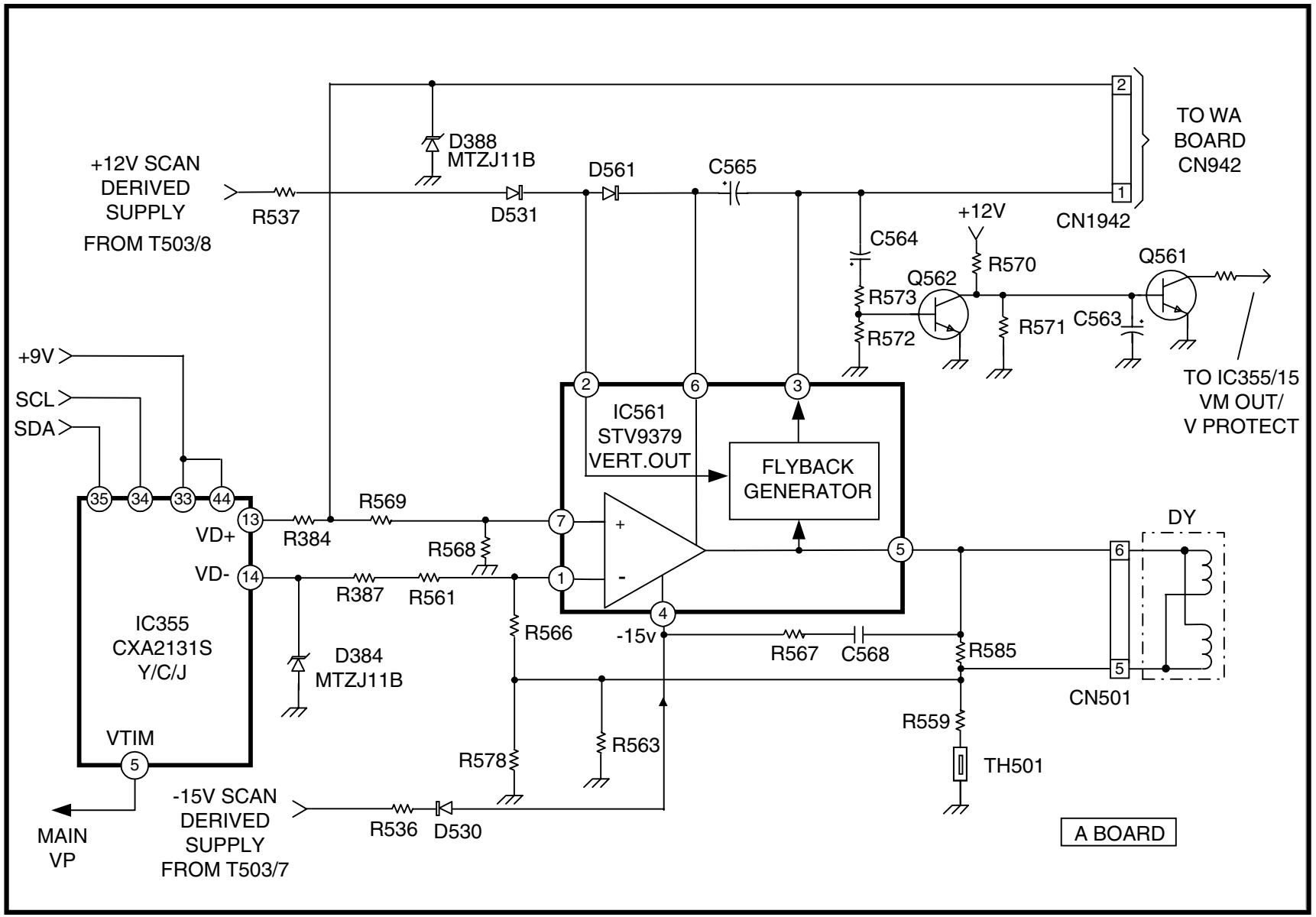

IC355/14 - 1V, 5ms


IC561/5 - 20V, 5ms


IC561/3 - 20V, 5ms


Q562/B - .5V, 5ms


CN501/5 - 1V, 5ms



VERTICAL DEFLECTION

10CTV26 1194 1/4/00

Horizontal Deflection Block

Overview

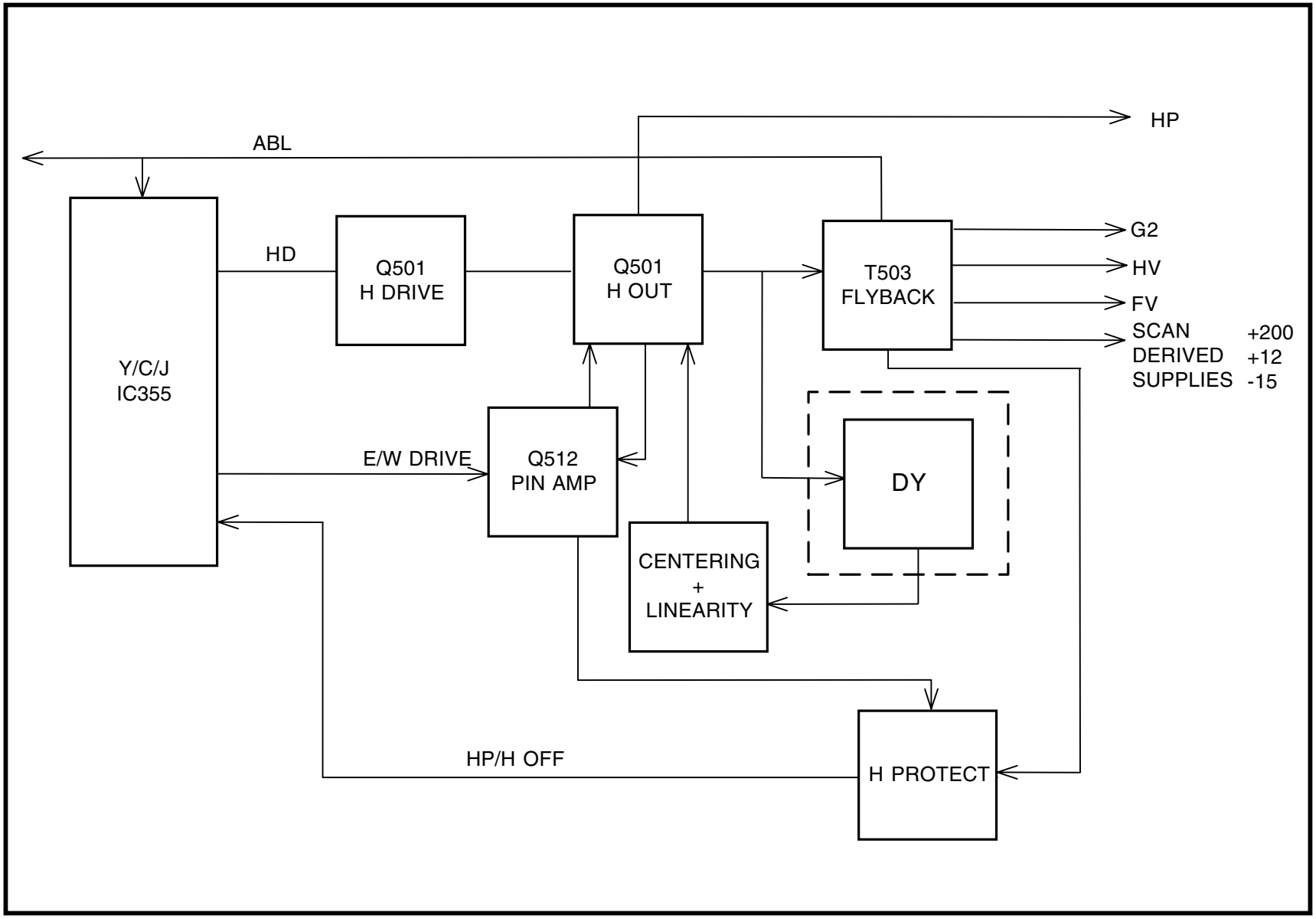
The horizontal deflection block creates the signal that drives the horizontal yoke and also drives the flyback transformer to create the necessary high voltage, focus voltage and other voltages used by the set.

The HD signal originates from the Y/C/J. The HD signal is applied to the amplifiers in the H drive and H Out circuits. The signal that exits the H Out transistor is applied to the flyback transformer and the deflection yoke. The deflection yoke uses magnetic fields formed by the current through it to drive the beam across the screen. Feedback from the yoke is coupled to the centering and linearity circuits. This circuit ensures that the picture will be linear and centered properly. These circuits work in conjunction with the pin amp on the return to the H Out.

The purpose of the pincushion circuit is to correct for deflection distortion, which occurs because of the yoke's inability to create a linear beam scan. The result would be a picture bowed at the sides. We compensate for this problem by using pincushion correction circuits to control the amount of current that can flow through the horizontal output's return.

More current is delivered so the beam can be pushed to the sides of the tube when necessary. The drive for the Pin amp is created in the Y/C/J and is called E/W drive. It is applied to the Pin amp with a sample of the HP pulse. Q512 controls the current through the H Out return.

A protection circuit also monitors the HP signal. This protection circuit allows HP signals to pass to the Y/C/J if the Pin amp and H Out circuits are operating normally. In the event of a failure, the HP/Hoff line to the Y/C/J would go LOW. The Y/C/J would then disable HD, which would cause high voltage to be lost.



HORIZONTAL DEFLECTION BLOCK

14CTV26 01/01/00

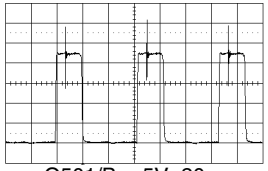
Horizontal Out

Overview

The horizontal output circuit below consists of the Horizontal Oscillator, Horizontal Drive, Horizontal Output, Flyback and Horizontal Centering and Linearity.

Horizontal Oscillator

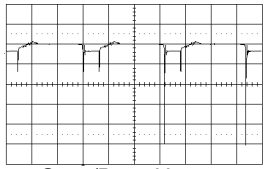
When the TV is turned ON, Set +9Vdc appears and is applied to Y/C Jungle IC355/33 and 44. IC355 contains a horizontal oscillator that is shaped into a horizontal drive pulse that leaves at pin 19.



Q501/B - .5V, 20us

Horizontal Drive

Q501 amplifies this HD signal and outputs the signal from its collector. This signal is coupled by T501 to drive the horizontal output Q502 B-E junction.



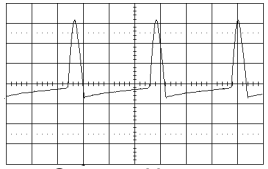
Q502/B - 10V, 20us

Horizontal Output

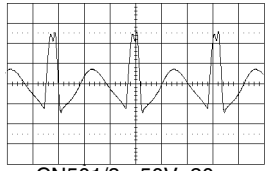
Q502 is the H output transistor and it drives two circuits:

- The deflection yoke – Develops a magnetic field in order to move the electron beam from left to right on the screen.
- The flyback transformers – Develops high, focus and screen voltages. The scan derived power supplies are also developed here. They are +200 volts, +12 volts and –15 volts for the CRT Amp and TV's vertical section. Heater voltage for the tube's filament is also developed here. The horizontal protection circuit also uses the heater voltage.

The HP pulse is fed back to monitor the frequency of the horizontal oscillator. The horizontal output is also modulated by Q512 Pin Out. This is necessary to correct for pincushion distortion that would be seen if correction were not used.



C510 - 10V, 20us

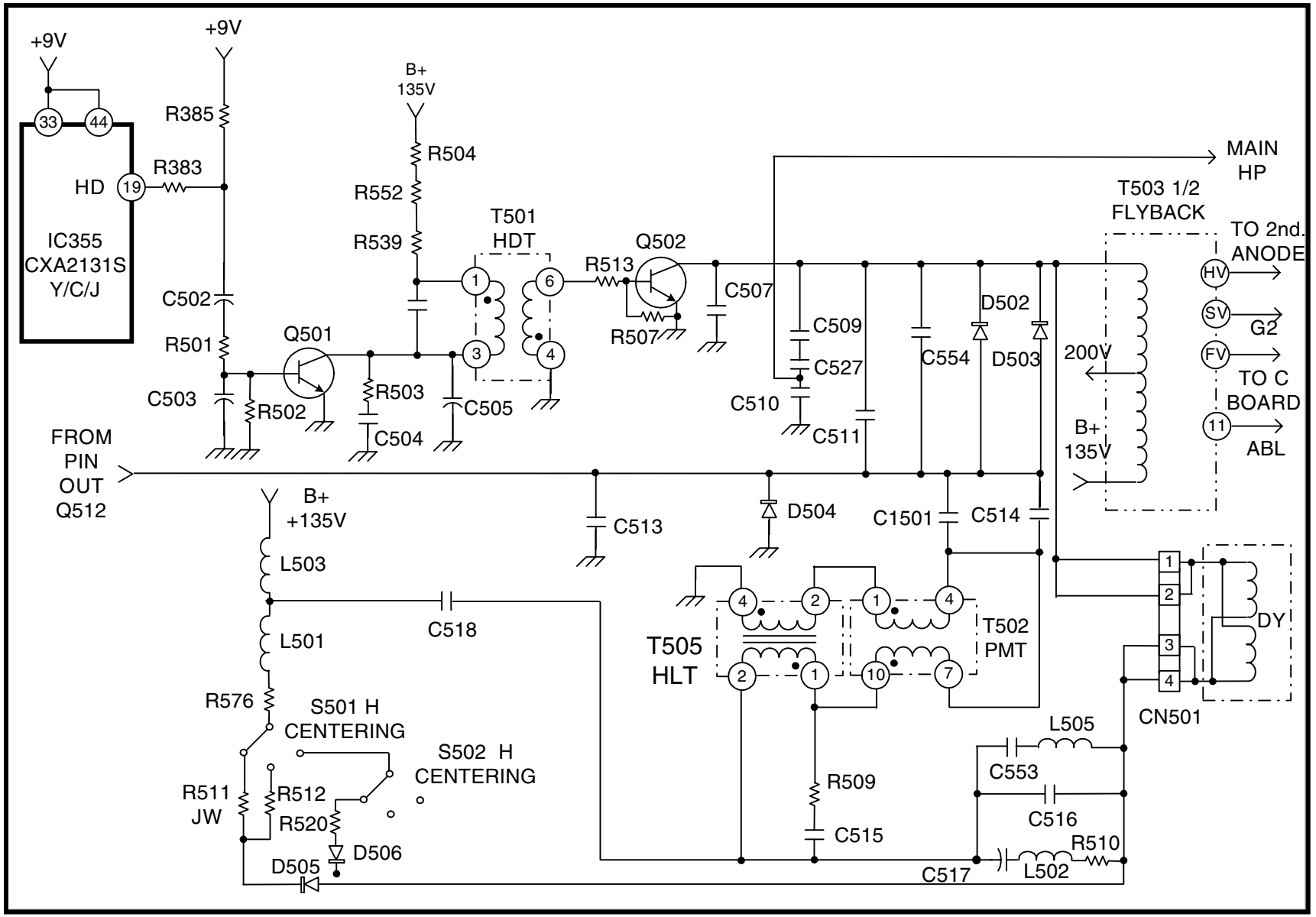


CN501/3 - 50V, 20us

Horizontal Centering and Linearity

Changing the DC voltage at the return line of the horizontal yoke performs horizontal Centering. The +135 volt line is switched through a series of voltage dividers using S501 and S502. The different combination of switch settings changes the DC level at the yoke return and, consequently, the centering of the picture.

Horizontal linearity is determined by feeding back the yoke return signal through an elaborate filter network, which is made up of T505 and its associated components to reference of the horizontal output.



H OUT

11CTV26 1193 12/22/99

Pincushion

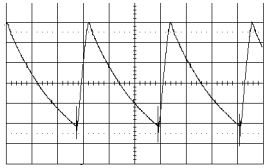
Overview

The purpose of the pincushion circuit is to correct for deflection distortion. This distortion occurs because of the yokes inability to create a linear beam scan. The result would be a picture bowed at the sides. We compensate for this problem by using pincushion correction circuits to control the amount of current that can flow through the horizontal output's return. More current is delivered so the beam can be pushed to the sides of the tube when necessary.

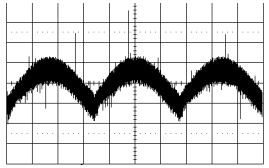
Circuit Description

The E/W signal from IC355/11 is input to IC501 Pin Control at its inverting input. A sample of the ABL signal from T503/11 is also input to this same input.

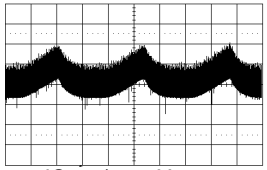
The main HP signal from C510 in the Horizontal Output section is applied to R524. The signal is applied to a clamp that consists of D518, D523 and D524. It is also applied to R525 and D516. This signal is now stripped of its negative component and integrated by C530. This signal is then applied to IC501/5 non-inverting input. IC501 Pin Control compares the inverting and non-inverting inputs and outputs their difference. The result is output at IC501/7.



IC501/5 - .5V, 20us



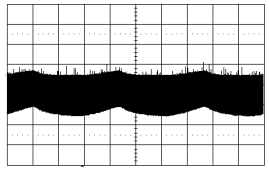
IC501/6 - .2V, 5ms



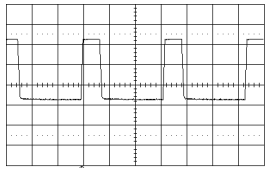
IC501/7 - .5V, 5ms

This signal is then applied to the base of Q511 Pin Out. The signal is inverted by Q511 and then input to the base of Q512. The result is that a PWM waveform is seen at Q512/C. Q512/C is connected to the return for the horizontal output. When Q512 Pin Out is conducting it allows more current to be drawn by the horizontal yoke. The conduction of Q512 is set up so that more current is drawn during the middle edges of the scanning of a horizontal line. The result is shown where the output leaves this circuit at R526.

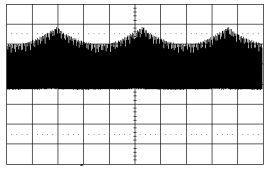
The H Protect circuit will remove the horizontal drive signal if the HP pulses are not input to IC501/5. This will also occur if Q511 or Q512 short.



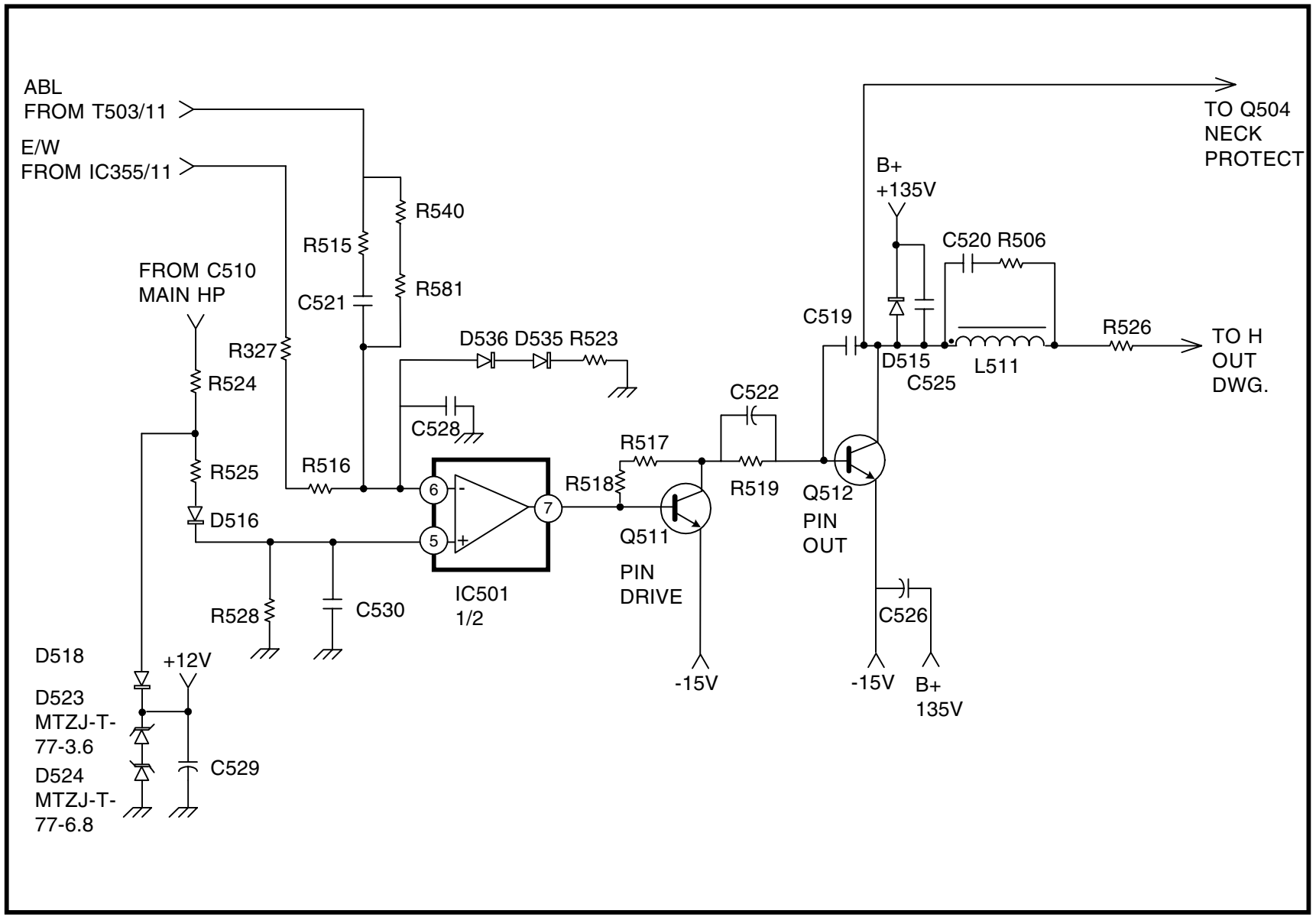
Q512/B - 2V, 5ms



Q512/C - 50V, 20us

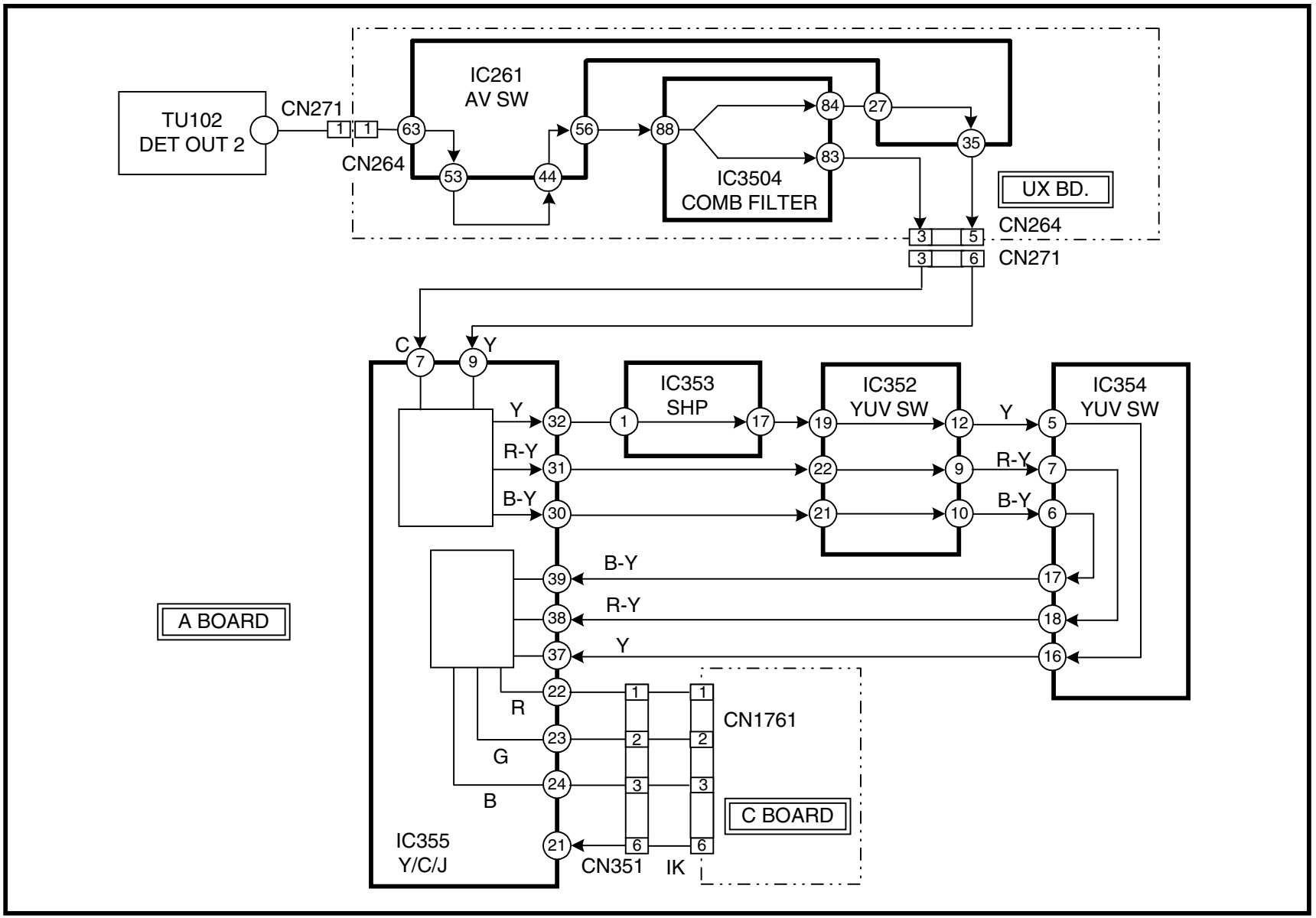


R526 - 100V, 5ms



PINCUSHION

12CTV26 1/1/00



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